INDEXED.

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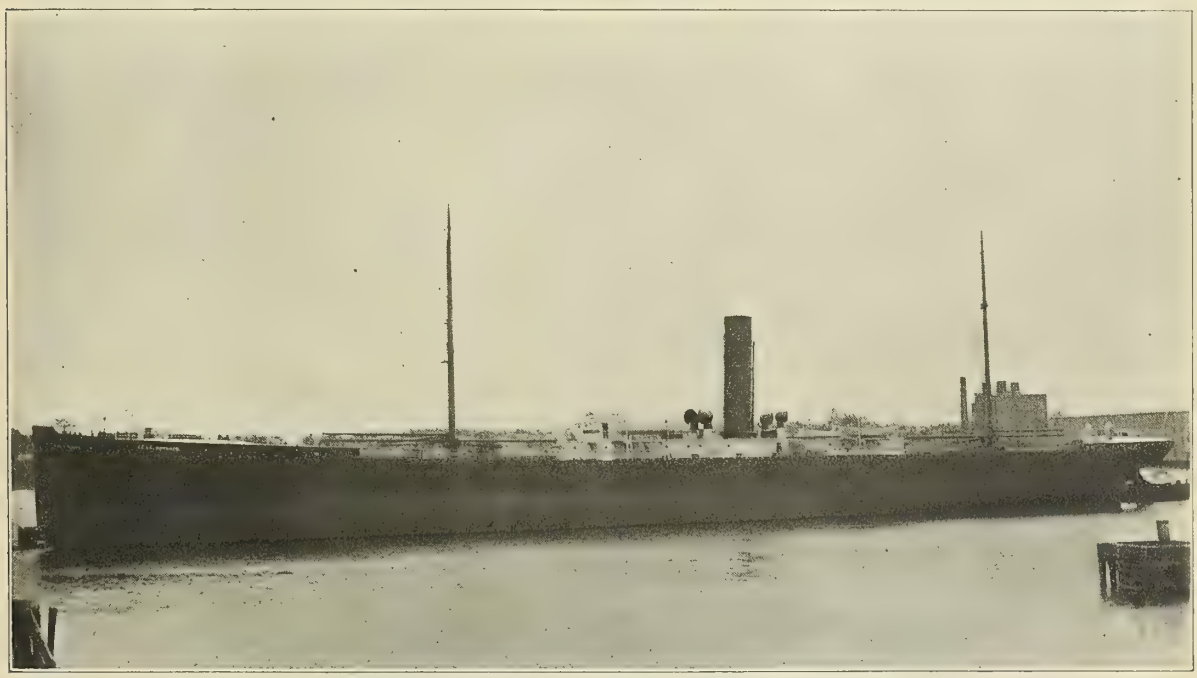
THE RECONSTRUCTED SAALE.

Seldom, except in the dismantling of a ship to become a coal barge, is there found such a great change in a reconstructed vessel as that which has been carried out by the Townsend-Downey Shipbuilding Company, Shooter's Island, New York, on the steamer formerly known as the *Saale*. It will be recalled by readers of MARINE ENGINEERING that this vessel of the North German Lloyd Steamship Company was one of three which were very badly damaged by the Hoboken pier fire two years ago.



THE FREIGHT STEAMER J. L. LUCKENBACH, FORMERLY THE SAALE.

The vessel was bought by Mr. Lewis Luckenbach for about $80,000, and was later taken to the shipyard of the above-mentioned firm for general overhauling. Little is left in this new freight steamer, named the *J. L. Luckenbach*, to remind one of the former passenger steamer *Saale*. All of the cabin and bridge house have been removed, and all space below the main deck—which is the weather deck—except that necessary for the engines, boilers, and coal, is given up to cargo space.

The forecastle for crew and firemen is located at the forward end of the 'tween decks. Under the forecastle head are the quarters for the boatswain, carpenter, cooks, carpenter shop, lamp, paint and store rooms, and toilets. In the forward steel deck house, which is around the boiler-room casing, are the quarters for the deck officers, officers' mess room, pilot and steward's rooms. Then comes a large coal chute extending the width of the house, leading to the athwartship bunker below. Aft of this are spare state rooms, the forward fidley grating, the galley, uptake, store room, and large fidley grating. At the forward end of the engine room deck house are state rooms for the chief engineer and his two assistants. The steering engine is located under the poop, and a new line of shafting leads to the pilot house.

With the exception of a small 10 by 10-foot hatch leading to No. 1 hold, all hatches are new. There are two hatches leading through all decks, 16 by 25 feet; one located forward and the other aft of the foremast, which is of steel and has four booms 42 feet long. At No. 2 hatch there is one cargo winch and at No. 3 hatch there are two winches. Between the engine and boiler rooms is a 16 by 12 foot hatch leading to the after 'thwartship coal bunker in the hold and to the cargo 'tween decks. The steel mainmast is stepped between the two main after hatches, which are 16 by 25 feet, and each hatch is served by two booms, the forward one by two winches and the after one by one winch.

As seen in the engraving, there is an open rail for-

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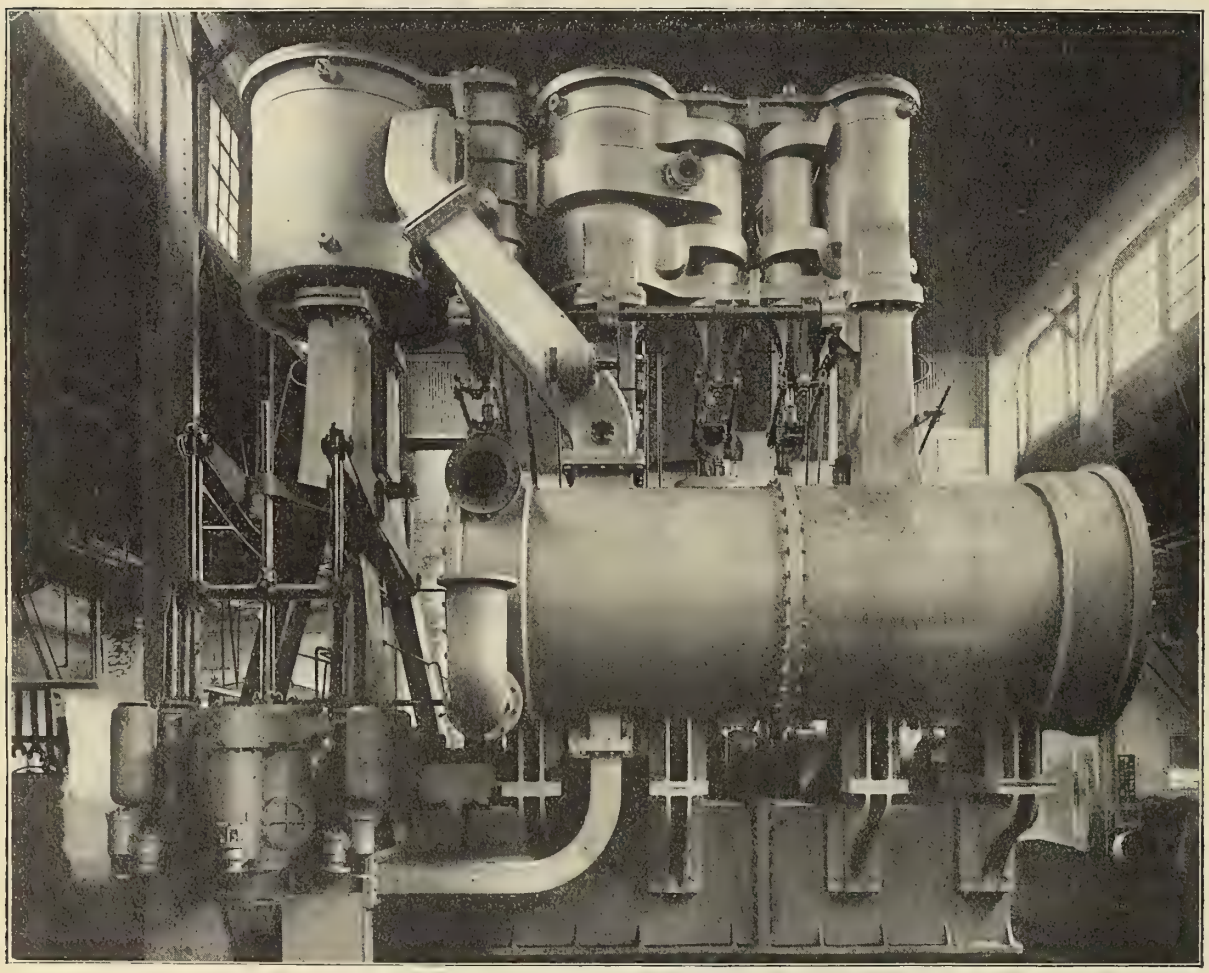
ward and aft, which greatly improves the general appearance of the ship. The pilot house and chart room are on the bridge deck. There are four lifeboats on this deck, and on either side of the bridge is a steel lighthouse. These lighthouses were formerly located at the break of the forecastle.

The general dimensions of the vessel are as follows: Length between perpendiculars, 438 feet; beam, 47 feet 10 inches; depth of hold, 34 feet 8 1-2 inches; draft, loaded, 28 feet aft, 26 feet forward. The ship has a bar keel, angle framing, and T bulb beams with forged knees. She has four complete steel decks forward and aft 'thwartship bunkers and in the wing bunkers is about 900 tons.

Fire lines are laid on the main deck, and steam pipes are led to each and every hold, to be used in case of fire.

Entirely new triple-expansion engines have been built by the Townsend-Downey Company, and the front and back views are shown in the accompanying engravings taken of the engines while standing on the erecting floor of the machine ship. The diameters of the cylinders are as follows: H. P., 26 inches; M. P., 44 inches; L. P., 70 inches, and the common stroke is 48 inches.



REAR VIEW OF THE TRIPLE-EXPANSION ENGINES FOR THE STEAMER J. L. LUCKENBACH.

and aft. In the course of repairing the vessel all the plating was faired up and the steel throughout was carefully scraped and painted. One-third of the main and 'tween decks is new and about fifty new steel plates had to be fitted on the sides. New bulkheads have been erected as follows: Between the second and third hatches up to the lower deck; at the after end of No. 3 hold to 'tween decks; the donkey-boiler recess was also moved aft 20 feet, and a new bulkhead erected between Nos. 4 and 5 holds up to the lower deck.

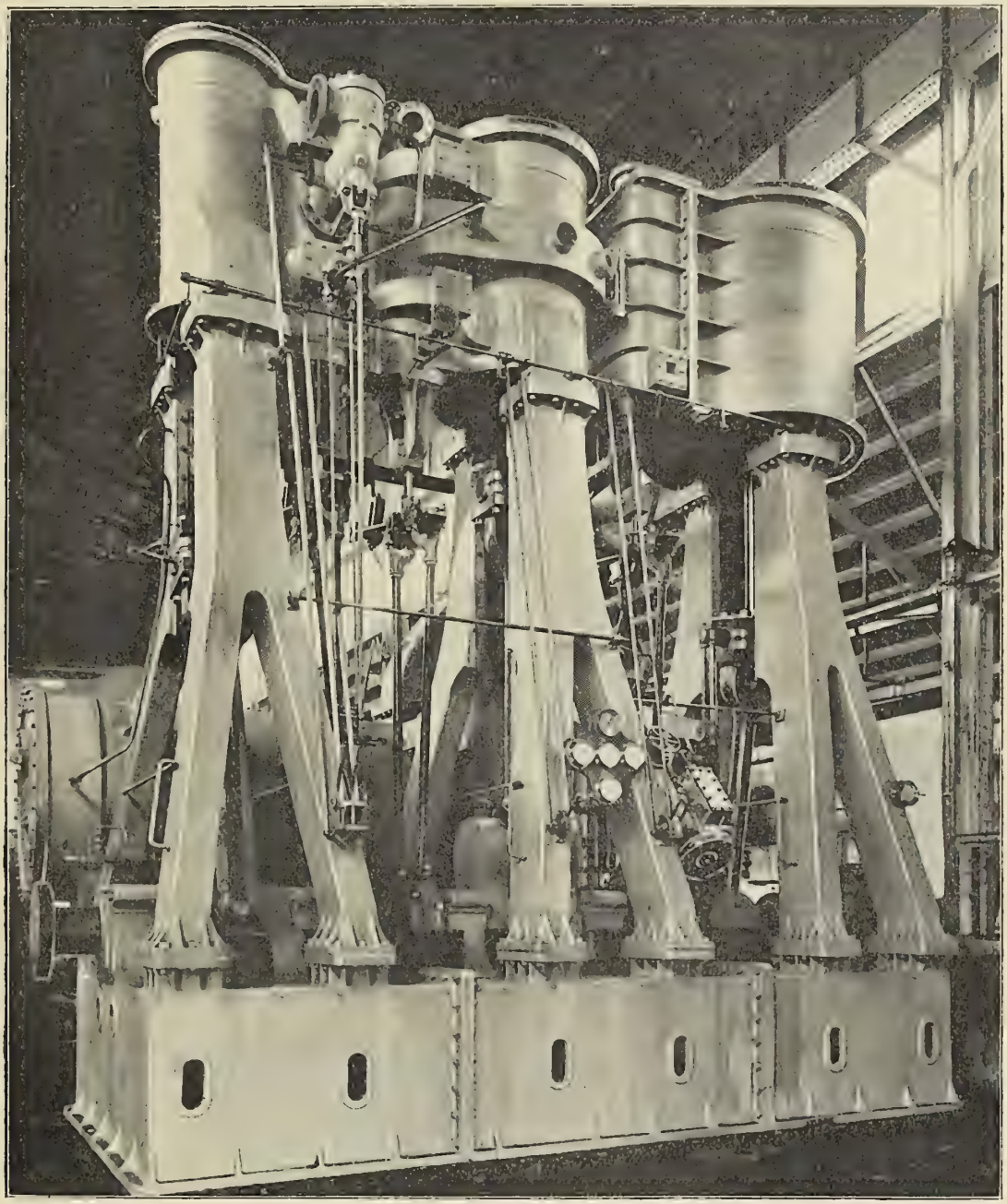
The *Saale* was equipped with four double-end Scotch boilers, but in the present ship the two forward ones have been removed. The coal capacity in the forward

The high and intermediate valves are of the piston type and placed between their respective cylinders. A double-ported slide valve is on the forward side of the low-pressure cylinder. The engine bed is a cast-iron box girder, and the cylinders are mounted on double Y cast-iron columns. The crank shaft is 13 5-8 inches diameter, of solid forged steel. The valve gear is of the Stevenson double eccentric type, operated by a steam cylinder which is seen on the front of the engine. The air and bilge pumps are driven by levers from the low-pressure crosshead, and a condenser, which is a separate casting, is bolted to the bed plate of the engine, as shown in the view on this page. The condenser has about 3,500

square feet of cooling surface. The two main boilers are 14 feet 2 inches diameter by 18 feet long and carry a working pressure of 180 pounds. There are three Purves furnaces at each end of each boiler, with a total grate surface of 266.5 square feet. The heating surface of both boilers is 7,544 square feet. The auxiliary boiler is a horizontal, single-end multitubular, 11 feet 5 3-4 inches diameter by 10 feet 5 1-4 inches long, with two furnaces. These three boilers are the ones which were formerly in this ship.

An eight-hour trial was recently carried out at sea with the vessel light, when a speed of 13.6 knots an hour was made. The revolutions per minute were 75, the total I. H. P. 2,500.

The *J. L. Luckenbach* leaves the shipyard as a fine type of ocean freighter. No money has been spared in remodeling her for the service in which she will be placed, as about $160,000 have been spent in this work. The vessel is classed in the Register of the American Bureau of Shipping.



ENGINES FOR THE J. L. LUCKENBACH, BUILT BY THE TOWNSEND-DOWNEY SHIPBUILDING COMPANY.

The United States Navy.—There are at present building in private yards for the United States Navy fifty-eight vessels in all. Eight of these are battleships.

POWERING SHIPS.

BY HORACE HOLDEN THAYER, JR.

Engineering data are of value chiefly as a basis for the estimation of new work, and any system by which these data may be accurately classified, standardized, and put into shape for immediate use is of great value to the estimator. The ideal foundation for a speed-power data classification is the "Law of Comparison," as set forth in "Resistance and Propulsion of Ships," by Durand.

While the full explanation of the law is not within the scope of this paper, the two of its statements made use of here are:

(1) The ratio between the powers necessary to propel similar ships at corresponding speeds is equal to the ratio of the products of displacement and speed.

$$\frac{H_2}{H_1} = \frac{D_2 u_2}{D_1 u_1}$$

The ship, propeller, and machinery should be similar.

(2) The corresponding speeds are to each other as the sixth root of the displacement ratio.

$$\frac{u_2}{u_1} = \left(\frac{D_2}{D_1}\right)^{\frac{1}{6}}$$

So having the speed-power data for any ship—say the displacement, power, and speed—the power for a similar ship of known displacement at a corresponding speed may be readily ascertained.

If an estimate of power is required for a 5,000-ton ship and the data at hand for a similar ship are,

$$D_1 = 10{,}590 \text{ tons},$$
$$H_1 = 16{,}224 \text{ I.H.P.},$$
$$u_1 = 20.75 \text{ knots},$$

the corresponding speed,

$$u_2 = u_1 \left(\frac{D_2}{D_1}\right)^{\frac{1}{6}} = 18.32 \text{ knots},$$

and the required power,

$$H_2 = H_1 \left(\frac{D_2 u_2}{D_1 u_1}\right) = 6{,}770 \text{ I.H.P.}$$

In general the power will be required, not at a corresponding speed, but at some desired speed, so that several ships have to be used and a curve run through the points obtained, from which the power at the desired speed may be read. As it is often impossible to obtain data for several ships exactly similar to the one in hand, the question arises as to what factor in the similarity should govern the selection of the type ships.

This paper embodies the results of an investigation along this line and demonstrates the practical utility of the "Law of Comparison."

Taking, first, data from a number of ships of both Government and merchant types, and, without regard to the question of similarity, calculating from each the power required to drive a hypothetical 5,000-ton ship, we obtain spots for a speed-power curve as shown in Fig. 1. While a mean curve drawn through these points would admit of too wide a variation to have practical value, it nevertheless would possess the characteristics of a speed-power curve and in so far proves the applicability of the law.

As the question of the propulsive efficiency of the engine and propeller enters into the problem to some extent, a classification on the basis of similarity of the machinery might be deemed of value, but the results (Fig. 2) show no greater accuracy than with no consideration of the similarity at all. That such a classification is out of the question is clearly shown by taking two widely different types—one making 70 revolutions per minute and the other 125.

As the power absorbed in overcoming the various kinds of external resistance—head, frictional, wave-making, etc.—depends largely on the form of the ship, that is the consideration of most importance in estimating from the results of previous performances. In an attempt to eliminate this factor, only those ships are used which have a block coefficient of from .55 to .60 (Fig. 3), but the estimate might still be wide of

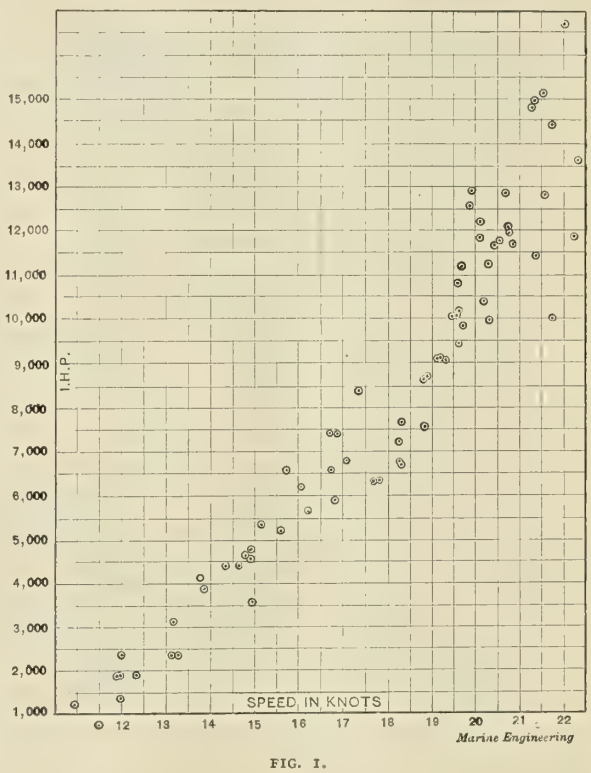


FIG. 1.

the mark. That the block coefficient cannot be used as a basis for classification is definitely shown from the fact that two vessels with a coefficient of .80 lie on the same speed-power curve as those just dealt with.

If we consider a ship's fore body as a wedge moving through the water, we note that a great factor in the resistance is the direct pressure of the water upon its two faces, and the greater the component of the surface perpendicular to the direction of motion the greater will be this resistance. With two ships of the same length and different beam, the more beamy vessel will have the greater component of surface perpendicular to the direction of motion, and we should therefore expect it to absorb more power in its propulsion at a given speed.

Comparing according to the proportion of length to breadth, and using all the data at hand for ships with

$\frac{L}{B}$ about 6.5, we obtain the definite series of points shown in Fig. 4, even though the type of ship has received no other consideration.

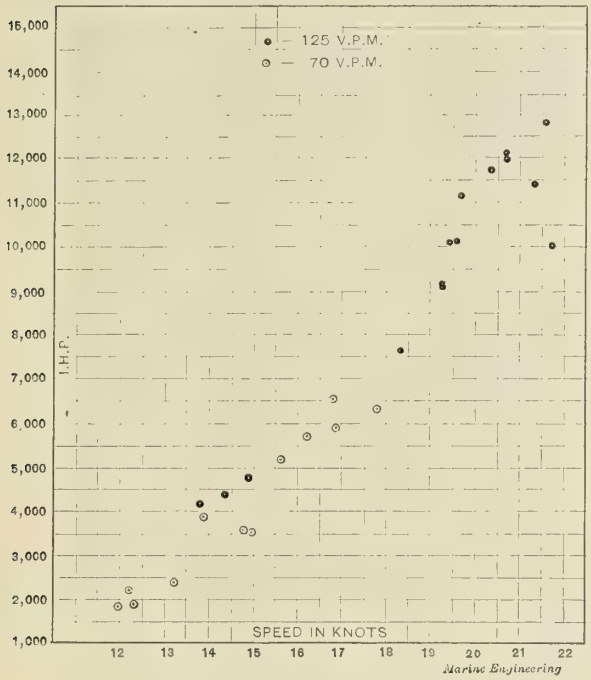


FIG. 2.

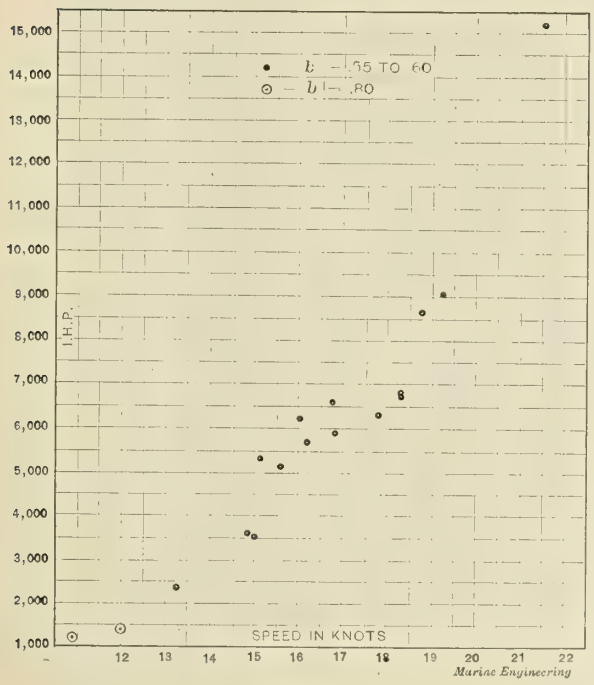


FIG. 3.

Both Government and merchant ships of various types are represented; the revolutions vary from 64 to 150 per minute and the block coefficient from .49 to .57. The lower series of points is for $\frac{L}{B}$ of about 8.7 and the upper series for a type of vessel with $\frac{L}{B}$ about 4.7.

Evidently there is here a basis for classification. The curves clearly indicate the superior economy of the long, narrow ship and the importance of the consideration of the beam factor in designing a ship which shall be easy to drive.

Having curves for various proportions of length to breadth for any one displacement, the power for a ship of any proportion at any speed and displacement may be obtained.

Given D_1, u_1, and $\frac{L}{B}$, the corresponding speed $u_2 =$

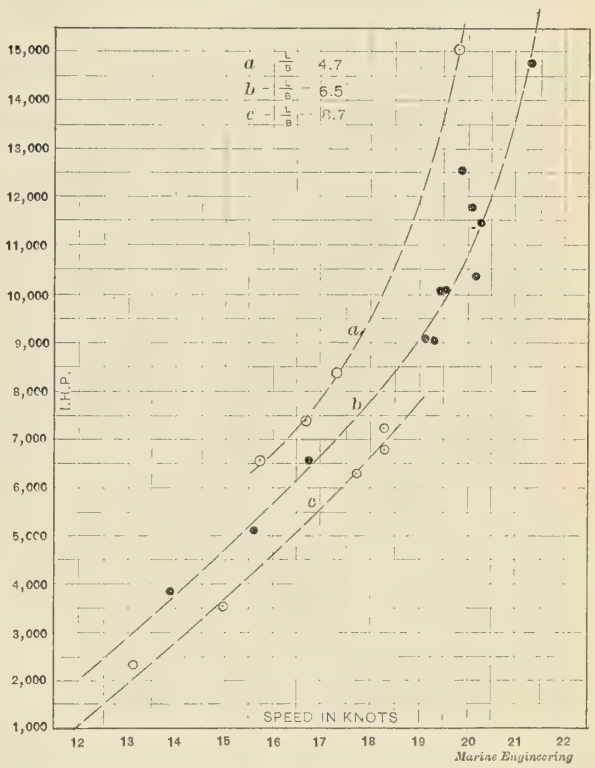


FIG. 4.

$$\left(\frac{D_2}{D_1}\right)^{\frac{1}{6}} u_1$$

and for this speed, u_2, the power of the type ship H_2 may be read from the curves. Then for this proportion of length to breadth,

$$H_1 = H_2 \left(\frac{D_1 u_1}{D_2 u_2}\right).$$

In order to obviate the necessity for calculating $\left(\frac{D_2}{D_1}\right)^{\frac{1}{6}}$ in each case, a curve of sixth roots may be plotted and the value read from it for the corresponding value of $\frac{D_2}{D_1}$.

Or suppose that there are at hand the particulars of a ship very similar to the proposed vessel. The power to propel a ship of the same displacement as

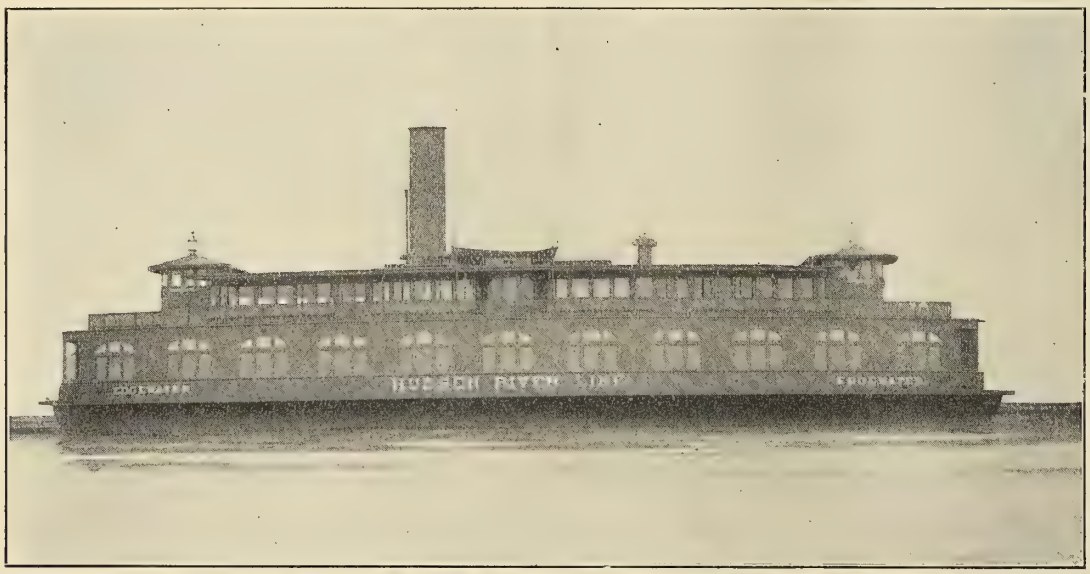
that of the curves at a corresponding speed may be derived from it, and through this point a line may be drawn parallel to the curve which shows the governing law for that proportion of $\frac{L}{B}$. Then from this curve the power of the new vessel at any speed may be derived.

From the results obtained by attention to the single feature of the proportion of length to breadth of a vessel in using her as the basis for an estimate, it can readily be seen that when the hull, machinery, and propeller of the type ship are similar to those of the proposed ship, the "Law of Comparison" gives very accurate results—much more so than any other method of estimation.

FERRYBOAT EDGEWATER.

The ferryboat *Edgewater*, here illustrated, has just been placed in service between 130th street and Edgewater, terminals of the New York and Hudson River Railway and Ferry Company. The vessel was built in Wilmington by the Harlan and Hollingsworth Company, and represents the finest type of boat for this service.

She is a double-deck steel ferryboat, with upper works somewhat similar in appearance to the Pennsylvania Railroad ferryboats, the lower cabins extending to the extreme ends. The length over all is 180 feet and the over-all beam 60 feet. The vessel is designed for speed, besides for service as an ice breaker for forcing her way through the large ice floats encountered in the upper part of the harbor.



FERRYBOAT EDGEWATER, BUILT BY THE HARLAN AND HOLLINGSWORTH COMPANY.

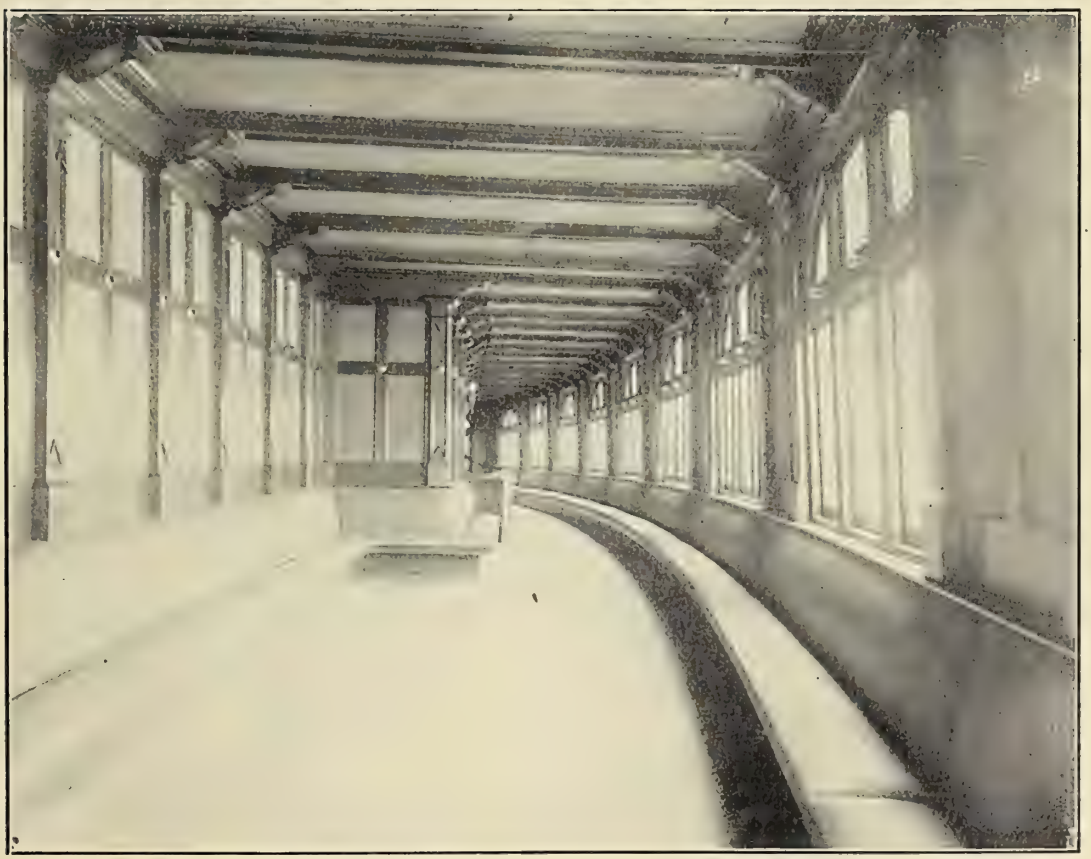
The main deck is in general of the usual arrangement. A cabin on each side extends the entire length of the boat, one being for smokers and one for non-smokers. Stairways in the centre of each cabin lead to the upper cabins. Between the main cabins are the usual teamways, with accommodation for thirty average wagons. For sanitary reasons the company experimented with a number of waterproof materials for the teamways, including rock asphalt, asphalt mastic, vitrified brick, granite block, and compressed cork brick, but these were found unsatisfactory on account of horses slipping on them when starting heavy loads. The paving material used is creosoted spruce, which is an improvement over the untreated wood. A portion of the center house between the teamways is used as a drivers' cabin, enabling these men to have a shelter in winter and still be close to their teams. The upper cabin is divided into two compartments, with large bay windows for general use. The promenade deck is provided with the usual seats.

Great care has been taken in the design of the interior finish. All cabinet work is of specially selected quartered white oak with plain moldings, giving a

New Steamers to the Orient.—A new line of freighters, to run between Seattle and the Orient, will start operations on the first of August. The first vessel to make the run will be the *Shawmut*. She will be followed by the *Lyra, Hyades, Pleiades,* and *Fremont,* all of which vessels are owned by the Boston Towboat Company.

Merchant Ships Docking at Algiers.—The Navy Department, under date of April 23, has issued a code of rules covering the docking of merchant vessels at the Naval Station, New Orleans. A charge of 20 cents per gross ton for docking and 10 cents per gross ton for demurrage for each and every day that the vessel remains on the dock will be made. No vessel whose displacement is less than 1,500 tons will be taken on the dock except in case of emergency.

Steamer Shortened.—An unusual dry dock operation is being performed by the Baltimore Marine Railway upon the propeller *F. W. Brune,* belonging to the Philadelphia and Baltimore Steamship Company. The steamer has been running on the outside route from Baltimore to Philadelphia, and as it is desired to run her on the inside route through the Chesapeake and Delaware Canal, she must be shortened 25 feet in order to pass through the locks in the canal.



VIEWS IN THE UPPER AND LOWER CABINS OF THE FERRYBOAT EDGEWATER.

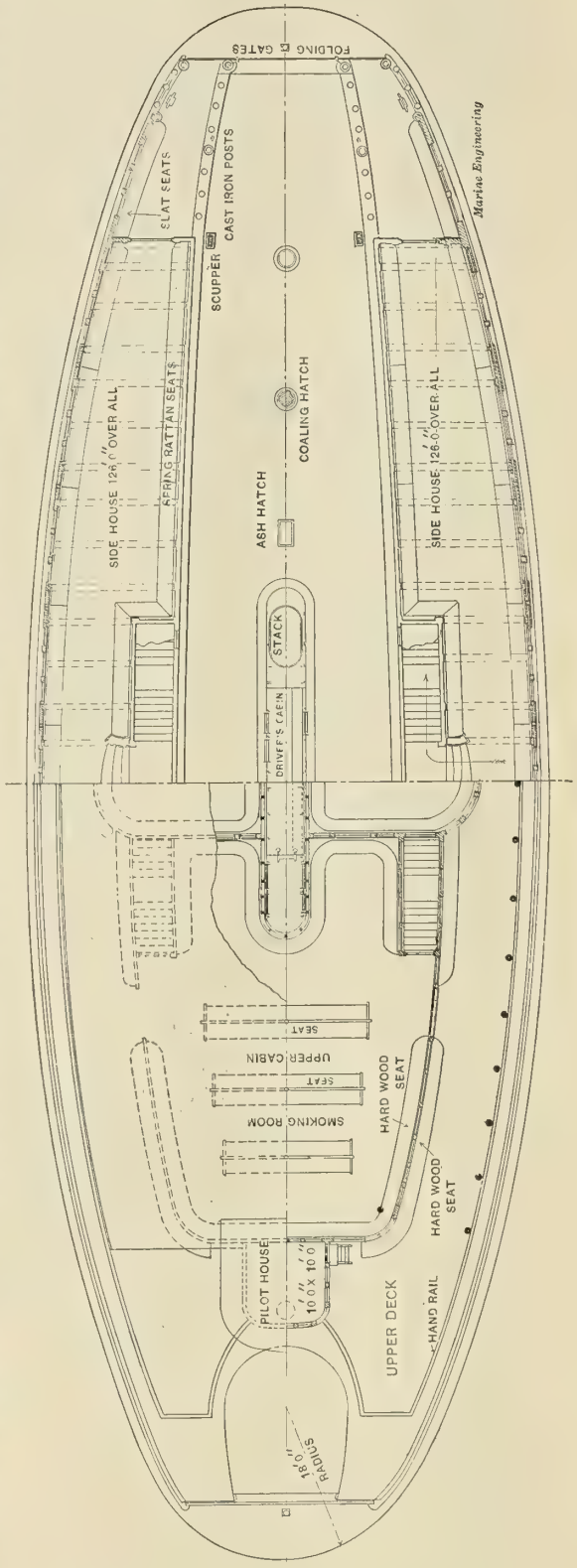
simple though elegant effect. The paneling of walls and ceilings is in burlap of natural color. A touch of bright color has been added in the elliptical transom windows of the lower cabin, which are of stained glass made by the Tiffany Company. The hardware and fixtures are of solid bronze. The color scheme is uniform throughout, harmonizing with the natural wood color of the oak. The lower cabin and stairway floors are covered with rubber tiling in a simple design, and the upper cabin floors with cork carpet. Spring rattan seats similar to those used in street cars are provided in the lower cabins, these affording additional comfort.

The boat is heated by the Sturtevant hot-air system. Cold air, which is taken in at an opening above the center house on the hurricane deck, is heated by being passed over steam coils in the hold, and is then blown into the cabins from outlets near the ceilings. Upon cooling, the heated air descends and is exhausted at openings under the seats and discharged into the open air by ventilating fans. The improvement over the usual system of heating by radiators under the seats, without any ventilation, is readily noticeable.

The hull is built of mild steel upon the vertical plate keel system, keel being 20 inches deep. As the vessel is of course a double-ender and has one propeller at each end, the stem and stern posts are the same at both ends and are made of cast steel, each in two solid castings, the frame being 4 by 6 inches. The rudder is of the double plate type, with 7-inch forged stock. The frames are 3 1-2 by 3 inches by 6.7-pound angles spaced 22 inches. The reverse frames are 2 1-2 inches by 5.1 pounds on every frame. Floors are of 12 1-2-pound steel, 13 inches deep at center, increased in weight under the engine and boilers. Rider plate is of 17 1-2-pound steel, 20 inches wide, and the four keelsons on each side of the vessel are each of double 4 by 3 inch by 8 1-2-pound angle, located as shown in section. Besides the two transverse collision bulkheads, there are two water-tight longitudinal bulkheads extending between the transverse ones and 12 feet 6 inches from the center line on each side of the vessel. The space formed by these bulkheads, which is about 131 feet in length, is divided into eight compartments, four on each side of the vessel. There is also a transverse sheet-iron bulkhead between engine and boiler rooms. In the outside plating it is noted that above the water line the strakes are increased in depth at the ends, so that the water-line strake is horizontal.

The deck beams are 5 by 3 inches by 12.7-pound angles, placed on every frame, except that above the midship bulkhead and at the ends of the midship house, heavy I-beams are placed. The beams on the guards are of Z section, 5 by 3 1-4 inches by 12 1-2 pounds, spaced 44 inches, and bracketed to the hull. The deck stringer plate is halved over the guard beams and riveted to them. The deck in the teamways is of yellow pine sheathed with yellow spruce. A steel deck is worked over the engine and boiler space.

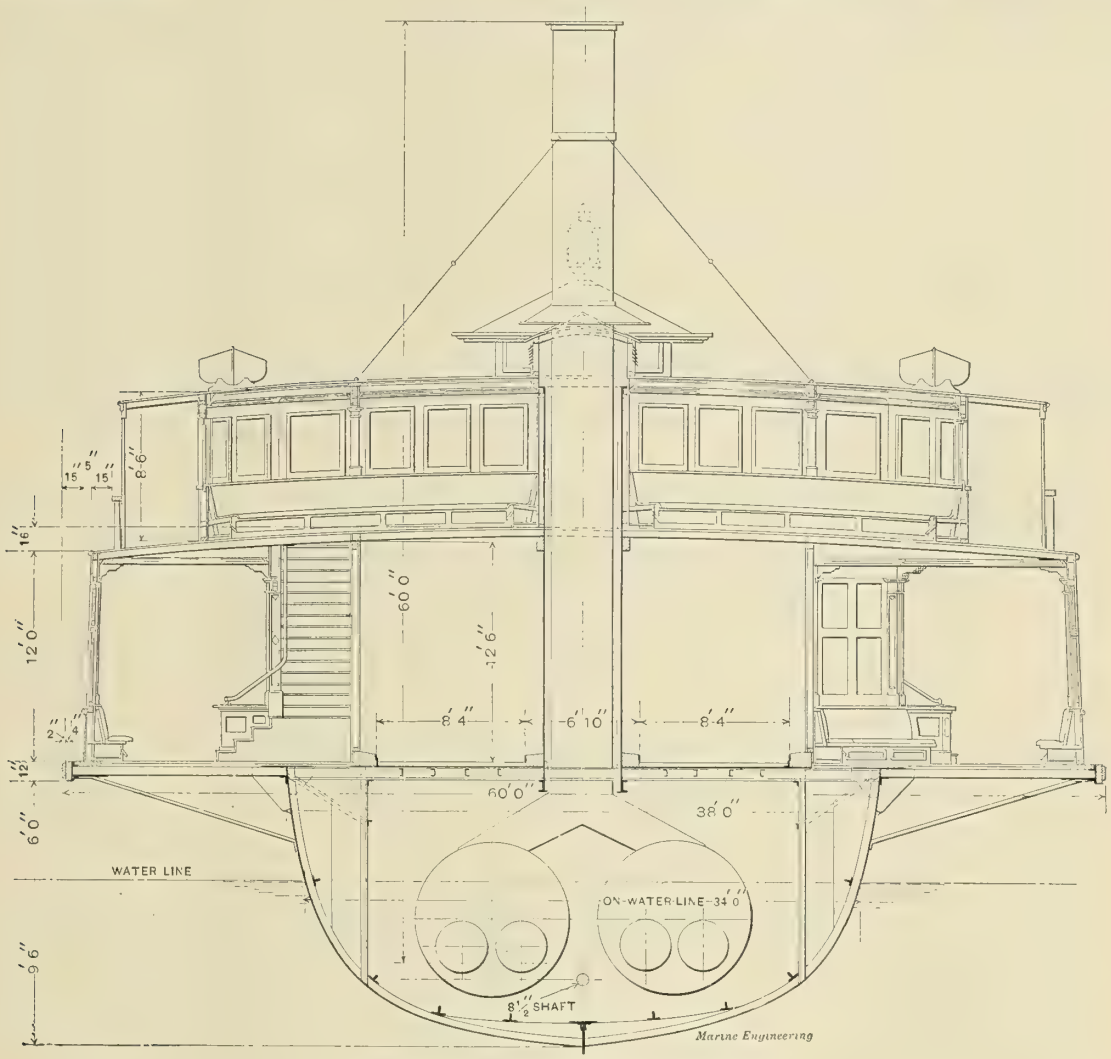
The deck and guard stringer bars are of angle section. The braces under the guards are on every beam and are of 2-inch oval iron, flattened at the ends. The plankshear is of oak, 3 1-2 inches thick and 18 inches wide, fastened by through bolts to the guard stringer



CABIN PLAN OF THE FERRYBOAT EDGEWATER.

bar. The fender is made up of staves of white oak 3 inches thick, faced with two widths of 3-4-inch iron, and from the ends of the staves is run a white-oak fender 4 by 12 inches, faced with a white-oak wearing piece 2 by 10 inches. The two fantail beams are of heavy angles, from which are worked 16 Z-bar radial beams, while the ends are covered by heavy plate and angles. A lattice girder is worked in between the collision bulkheads and the fantail beams on line with each longitudinal bulkhead.

square-column frames, with two legs under each cylinder. The bed plate is also of the box-girder form. The crank shaft, 8 5-8 inches diameter, is of built-up steel forgings. The pistons are of cast iron and the rods open-hearth steel forgings 7 1-2 inches diameter. The crossheads are of forged steel with crucible steel pins. The reversing gear is of the Stevenson type, operated by a steam cylinder. The steam exhausts into a Wheeler condenser mounted on a Blake compound air and circulating pump. The diameter of the steam cylin-



MIDSHIP SECTION OF THE FERRYBOAT EDGEWATER.

The cabin decks are laid in yellow pine, and the wings with white pine. The center house is of 7-pound plate and extends up to the hurricane deck. Under each pilot house is built the steering column, of lattice pattern, so arranged as to carry the weight of the pilot house and to accommodate a hand and steam steering gear. The safety gates furnished at each end are of the pantograph lattice style, supported by iron posts.

The three-cylinder compound engine drives through the continuous line of shafting a propeller at either end of the vessel. The high-pressure cylinder is fitted with piston valve, and the two lows with double-ported slide valves. The engine is supported by cast-iron

der of pump is 12 inches, air cylinder 14 inches, water cylinder 14 inches, and the common stroke is 10 inches. A closed feed-water heater to raise the temperature up to 180 degrees by the use of the auxiliary exhaust is installed. There are two thrust bearings, one forward and one aft of the engine, of the horseshoe type, with eight forged collars and nine shoes each. The line shafting is 8 inches in diameter, and the propeller shaft 8 1-4 inches. The stern bearings are 1-2-inch brass liners with lignum vitæ staves 3 feet long. The usual form of stern tube is used.

There are three steam pumps and one hand pump, the feed pump being 7 1-2 by 4 1-2 by 10 inches. The fire

pump is horizontal duplex, with cylinders 8 and 5 inches by 12 inches stroke. The bilge pump is worked from the end of the circulating pump rod. There are two sets of steam steering gears, with columns from the pilot house and leads taken to the quadrants.

There are two Scotch boilers, furnishing steam at 125 pounds pressure, and in each are 170 lap-welded 3-inch tubes 8 feet 6 inches long. There is one steam drum 3 feet in diameter, 8 feet 3 inches long, made up of 3-8-inch plates. Steam enters the drum from each boiler through nozzles at the lower part and leaves the drum through one nozzle at the top.

There are two electric generators located in the engine room, one of 10 and the other of 25 kilowatts capacity, direct-coupled to vertical engines, the voltage being 125. The electric lighting system is very complete, there being about 50 per cent. more lamps used than on the best-lighted ferryboats in the harbor.

To insure the success of the boat a corps of engineering specialists was engaged in its design, Col. E. A. Stevens, of Hoboken, Capt. C. W. Woolsey, and Mr. H. B Roelker supervising the design of the hull and machinery, and Messrs. Ford, Bacon, and Davis the electrical equipment and interior arrangement and finish.

At a later date we expect to publish the full results of the acceptance and progressive trials recently conducted by Col. Stevens.

The Stern-Wheel Steamer Alianza.

Herewith are presented the drawings and description of the steel stern-wheel steamer *Alianza,* built by the Pusey and Jones Company, Wilmington, Del., for service in Venezuela. This vessel is another evidence of the hold that our shipbuilders are taking upon the trade of South America. The *Alianza* was erected at the yards of the builder, and then taken apart in sections and shipped complete by sailing vessels to the point of destination, where the parts were assembled and the vessel placed in commission.

The hull is of steel, built as light as possible consistent with the proper strength, and of good model. The chief objects considered in her design were speed and light draft.

Four transverse water-tight steel bulkheads divide the hull into five compartments. Large hatches lead down to compartments two, three, and four, and small hatches into the end compartments. The vessel is stiffened longitudinally by a hog frame, with tie rods to support the end weights of boiler, engine, and stern wheel, the arrangement of which is shown on the elevation. On the main deck, forward, are a steam capstan and a double stairway leading to the promenade deck. Aft of this, on the centre line, is a boiler of the locomotive type, fired at the forward end.

Name—Alianza. Nationality—Venezuelan. Type—Stern-Wheel Steamer.

Launched—1902. Builder—Pusey and Jones Co.

Length on deck	137 ft. 0 in.	Length	33 ft
Beam, molded	27 " 6 "	G. S.	28 sq. ft.
Beam over guards	34 "	H. S.	2,161 sq. ft.
Depth, molded	5 " 6 "	**Tubes**	2 sections of 2½-inch tubes.
Draft, loaded	48 "	Number of, in each section	155
Engines, number	2	Length	5 ft. and 14 ft.
Type .. Single, high pressure, non-condensing.		Steam dome, diam	36 in.
Cylinder, diam	18 in.	Length	18 ft.
Stroke	72 in.	**Wheel,** material..Arms and buckets yellow pine, rims iron.	
Speed, in still water	15 miles.	Diameter	21 ft.
Boilers, number	1 locomotive.	Depth of buckets	18 in.
Pressure	150 lbs.	Width of buckets	14 ft.
Diameter	5 ft. 3 in.	Number of buckets	18
Width of front	6 ft. 3 in.		
Height	8 ft.		

Name—Edgewater. Nationality—American. Type—Ferryboat.

Launched—1902. Builder—Harlan & Hollingsworth Co. Owner—N. J. & H. R. R. & Ferry Co.

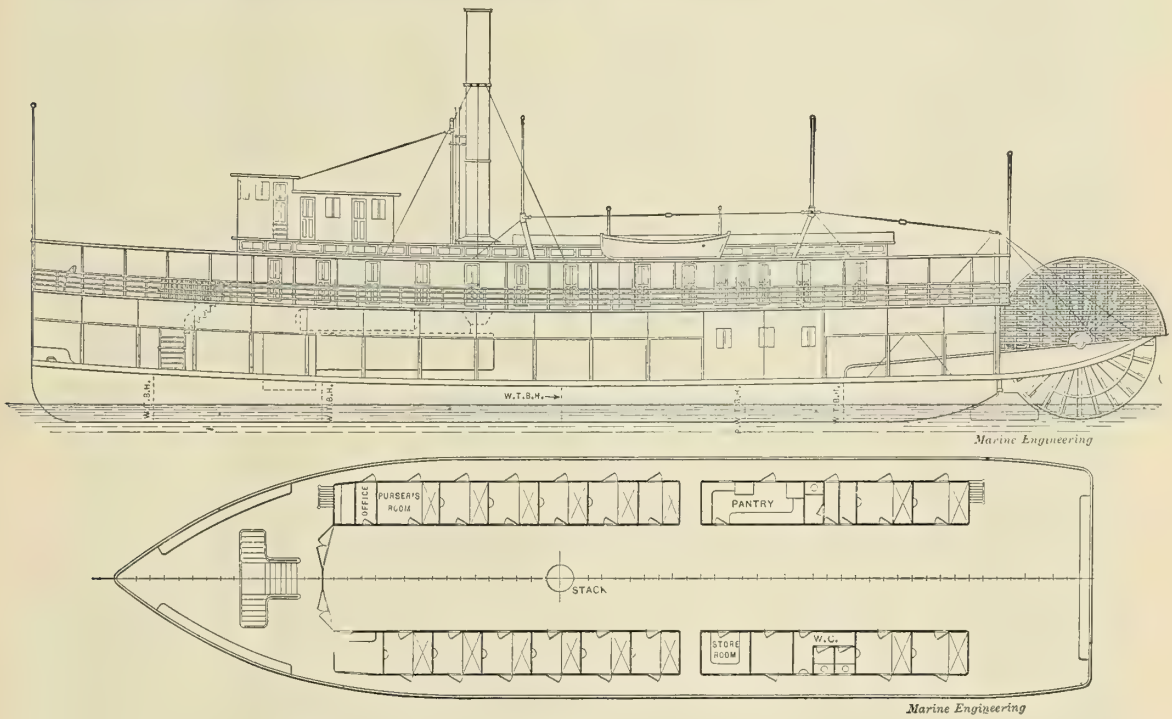
Length over all	180 ft.	**Propellers,** number of	2
" between stems	176 " 6 in.	Material	Solid cast steel
" stern posts	146 " 6 "	Blades	4
Beam, molded at deck	39 " 9¼ "	Diameter	8 ft.
" over all	60 "	Pitch	8 ft.
" at water line	34 " 2 "	Area	
Depth, molded	15 " 6 "	**Boilers,** number of	2 single end Scotch
Draft to bottom of keel	10 "	Pressure	125 pounds
Freeboard at end	6 "	Diameter	10 ft 6 in.
Engines, number of	1	Length	11 " 6 "
Type	3 cylinder, compound	Furnaces	2 each
Cylinder diameters	22, 30, 30 in.	Diameter	42 in.
Stroke	24 "	G. S. total	92 sq. ft.
Designed R. P. M.	150	H. S. total	2,940 " "
" I. H. P.	850	Draft	Natural
Speed	12 knots	H. S. ÷ G. S.	30.87
Condensing surface	1,250 sq. ft.	H. S. ÷ I. H. P.	3.46
		I. H. P. ÷ G. S.	9.24

Abreast and aft the boiler the main deck is open for carrying freight, and on the port side is a small house containing store room and mess room, and in a corresponding house on the opposite side is the kitchen and store room. Two high-pressure, non-condensing engines are located at the stern, one engine on either side driving the stern wheel. The engine room is not enclosed, and a small house at the stern is used for the engineers' stores.

The arrangement of the promenade deck is such as to insure comfortable quarters for the passengers. Two lines of state rooms, one on either side, extend aft from the forward stairway. In all, there are fifteen two-berth rooms, which open both outside and inside. In this house are also the purser's room, pantry, store room, toilet rooms, etc. A bulkhead runs between the two tiers of rooms at the forward end, but the cabin is open at the after end and amidships to the outside deck. A skylight extends the length of the cabin, admitting air and light. The pilot house is located on the deck above, the forward end being in line with the forward end of the cabin. Aft of the pilot house are the captain's, pilot's, and engineers' rooms.

Each high-pressure engine has a cylinder 10 inches in diameter and 72 inches stroke, fitted on a strong steel frame on the main deck and connected at right angles to the main shaft. Slide valves worked by a link motion are fitted, and each cylinder has an independent cut-off. The wheels are of the radial type, with iron rims, yellow pine arms, and buckets of yellow pine in two lengths, the buckets on one side being placed half way between those on the other. The shaft is of steel, and five cast-iron centre hoops are mounted, on each of which is fastened a steel plate; the center rows of arms for one of the sets of buckets is made in short lengths. The wheel is covered by a wooden wheel house.

The locomotive boiler above referred to is in two sections, with a combustion chamber placed between them. There are 155 2 1-2-inch tubes in each section, 5 feet and 14 feet long, and the total length of the boiler is about 33 feet and the diameter 5 feet 3 inches. A steam dome 33 inches in diameter and 18 feet long is placed above the boiler. The boiler was built according to the U. S. Steamboat Laws for a steam pressure of 150 pounds.



ELEVATION AND PLAN OF A SOUTH AMERICAN STERN-WHEEL STEAMER.

Naval Manœuvres.—The Navy Department has issued orders for assembling next winter the vessels of the North Atlantic, South Atlantic, and European stations to participate in the West Indies in the most extensive fleet manœuvres ever attempted by the Navy. The list of vessels which will take part includes seven first-class battleships, two armored cruisers, eight protected cruisers, and five small cruisers, besides all available torpedo boats, colliers, and supply ships.

Catamarans.—The Jenks Shipbuilding Company is building for the United States Lake Survey seven catamarans, each 40 feet in width. Each catamaran has two large steel cylinders 30 feet long and 40 inches in diameter. When completed the catamarans will be fastened together, side to side, and be used for sweeping parts of the St. Lawrence river to ascertain obstructions to navigation. Weights with poles attached will be lowered between the catamarans and the various depths noted at the water line on the poles.

DOCKING FACILITIES ON THE PACIFIC COAST.

BY WILLIAM H. CRAWFORD, JR.

The eyes of the commercial world are now looking toward the Pacific Coast of the United States as the most promising field of future development in the most prosperous country in the world.

With the growth of Oriental countries and the extension of our commercial relations to these nations, as well as to our new island possessions, we can see in the near future a great merchant marine on the Pacific. San Francisco is, without doubt, destined to be the metropolis of the Western World. Its natural advantages assure this fact, and the works of man all tend to provide for the wonderful developments of the future.

Up to the present time one of the greatest needs has been proper provision for docking ships, there being but two dry-docks of any importance in the harbor of San Francisco, one at Mare Island Navy Yard and the other at Hunter's Point. Within the last few months, however, work has been started on two new docks which, when completed, will rank among the largest in the world, capable of handling any ships now afloat, with a margin to spare for what the next few years may bring forth. One of these new dry-docks is located right beside the old one at Mare Island Navy Yard, and, strange to say, the other is as close to the old Hunter's Point dock as safety will permit. This latter fact is the result of certain natural conditions that make it an interesting subject for investigation, and which further attract us when we know that while the work here will cost in the neighborhood of $500,000, it will take about $1,800,000 to accomplish the same end at Mare Island Navy Yard. Both docks will be of the same size when completed, 750 feet long, 122 feet wide at the top and sloping down to 74 feet at the bottom, with a depth of 32 feet of water in the dock at high tide. The illustrations here shown are all views of the work now being prosecuted on Hunter's Point Island.

Many centuries ago a rocky island lay a few hundred yards off the bay shore in the neighborhood of San Francisco's present site, but by a change of currents this channel was gradually filled up, until at the present time we have a prominent head of land connected with the main shore by a less prominent and low-lying strip. This is the Hunter's Point of to-day. The old dock and the new one are both cut out of the solid rock which forms a natural basin, and open into water with a depth of about of 40 feet.

The first illustration is a view of the excavation looking toward the future opening. At the right-hand wall of the excavation the strata of rock slope down toward the front and indicate the bed of an old-time channel between the rocky head and the mainland.

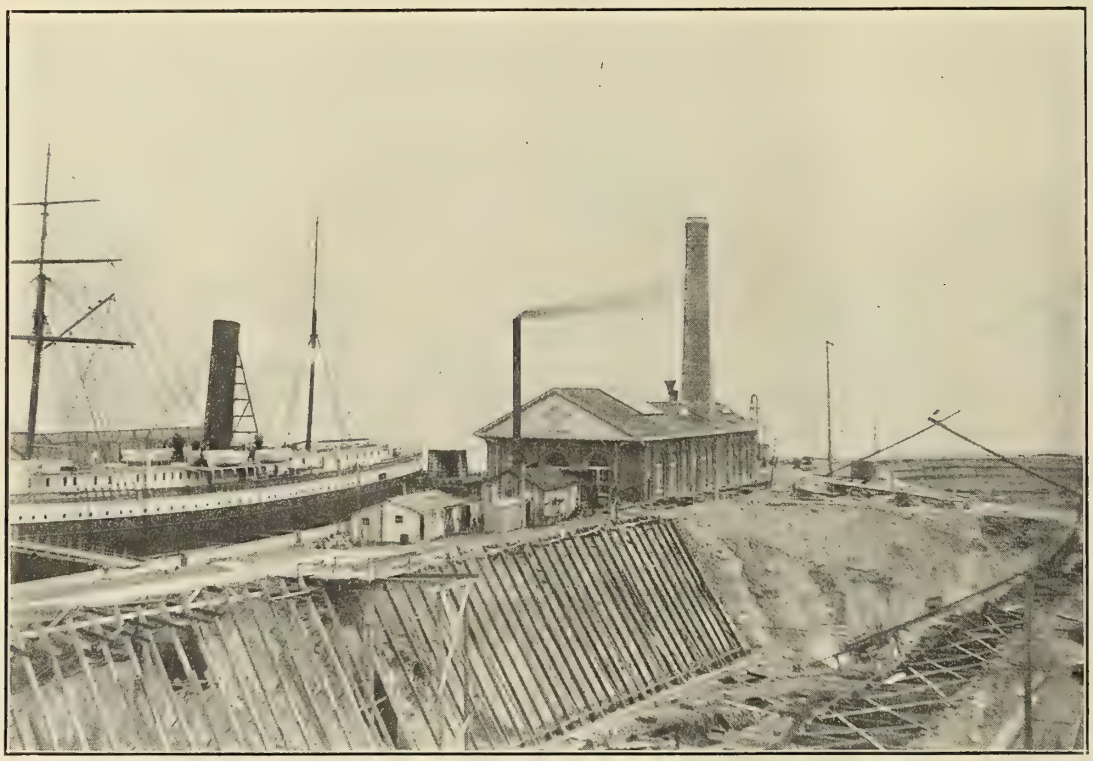


FIG. 1.—VIEW OF NEW DRY-DOCK AT HUNTER'S POINT, SAN FRANCISCO BAY.

Illustration No. 2 is also a view of the natural rock basin looking inland from the water end. This portion of the dock is about ready for its cement lining, and the upper end, it will be seen, has already received its coating. The sides of this dock will not be stepped as with the old one, save for seven steps at the bottom and four at the top. Between these the walls will be flat. There will be four places on each side where stairways will be built to allow access to the bottom of the dock.

A pile driver may be seen in the left-hand background of this picture, and it was from the top of this that view 1 was taken. Here may be seen the

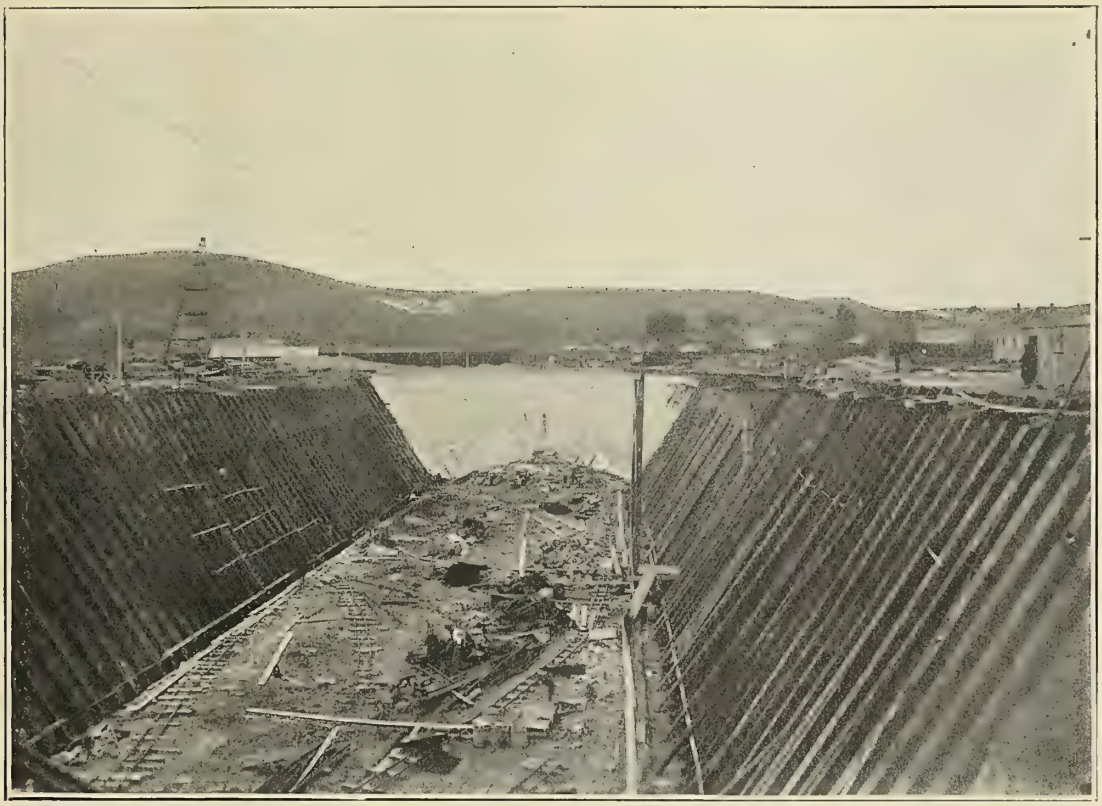


FIG. 2.—NEW HUNTER'S POINT DRY-DOCK FROM THE BAY.

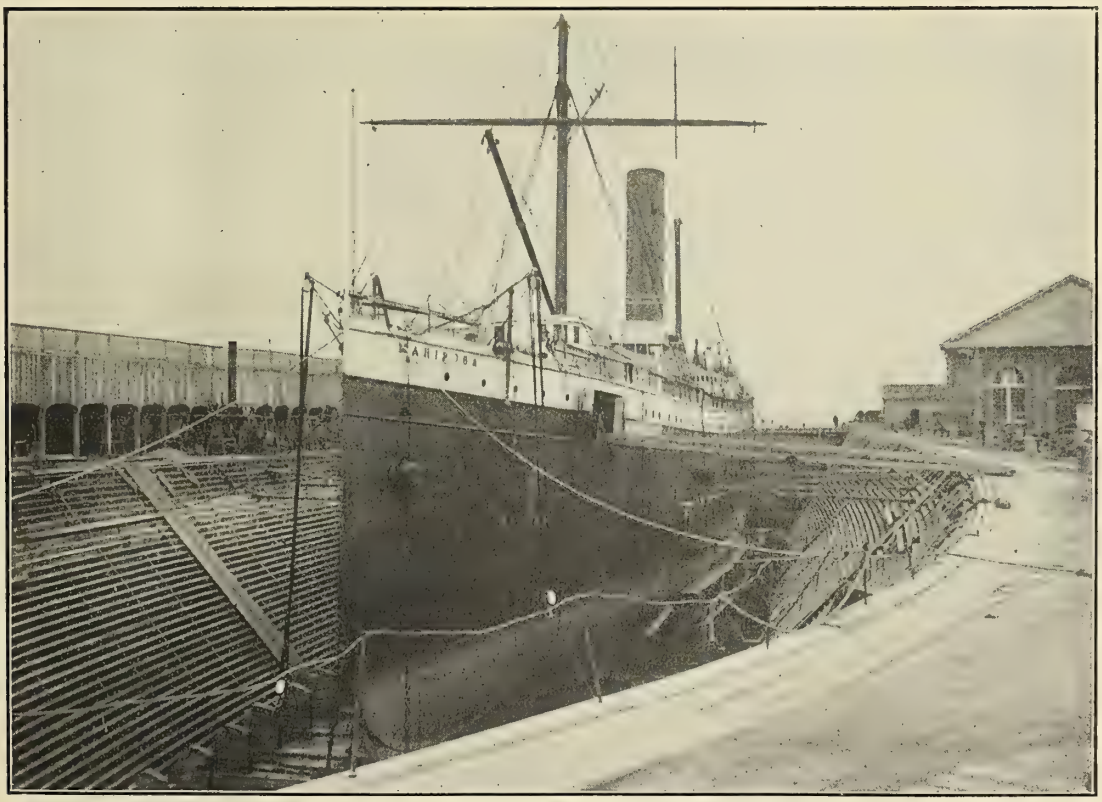


FIG. 3.—OLD DRY-DOCK ADJOINING THE NEW HUNTER'S POINT DOCK.

pump house, located between the two docks, also the portion of rock that has yet to be cut away, and the close proximity of the old dock in which there is a steamer. A cofferdam is built around the future opening of the new dock, which shows up very well in No. 1. A faint glimpse of the upper end, the cemented portion of the new dock, is also visible in this picture. Illustration No. 3 gives an idea of what the old Hunter's Point dock looks like and shows on the blocks the old *Mariposa,* the steamer referred to above. She is one of the pioneer ships sailing from this port, and, with the *Alameda,* has been variously engaged in the Australian and Hawaiian service since 1882. At present this vessel is being overhauled by the Risdon Iron Works and converted into an oil-burning ship. She will be the second ocean craft regularly leaving this port and burning liquid fuel, the first being the S.S. *Enterprise,* which is at present engaged in the Hilo, Hawaiian Island, trade.

The old dock shown in this picture has done great service in its day. The U. S. S. *Oregon* was able to squeeze in here with a 4-inch margin after her rudder had been removed. No such troubles will be experienced with the new one, however, for many years to come, and its great size will not necessarily retard the work of docking, for it is estimated that with the present pumping plant a ship can be docked in about one hour and twenty minutes. There are three centrifugal pumps with a total expelling capacity of 180,000 gallons of water per minute. These pumps are fitted with rope-drive pulleys, a constant tension being kept on the rope by the usual weighted compensating wheel.

For those who are interested in the future development of this great port we can promise much to be seen in the years to come. The great work of the Santa Fé Railroad in filling in the China Basin will probably be eclipsed by some greater undertaking. The San Francisco *Chronicle* sounds a note of warning in an editorial under date of May 26, "More Water-Front Facilities," which says in part: "Everything points to the fact that the Harbor Commission will be called upon at an early date to rearrange the entire water-front facilities of this port to accommodate the increased demands of commerce. It cannot be undertaken too soon. *The growth of ocean commerce here is unprecedented.* New steamship lines, with vessels of the largest tonnage, are being created which contemplate making San Francisco their home port. A new ferry line across the Bay is in sight. The sail fleet is increasing as fast as half a dozen busy shipyards can comply with the orders of their customers. Facilities for this increased shipping must be provided. What are we going to do about it? This is the question before the Harbor Commission. The question cannot be dodged. We are confronted on the water front with a condition, not a theory."

American Registry.—It is stated that many vessels flying foreign flags are being transferred to the Danish flag, with the Danish West Indies as their home port. This is done with the expectation that Congress will ratify the treaty of the purchase by the United States of the Danish West Indies, when all vessels registering at that port will pass under the American flag.

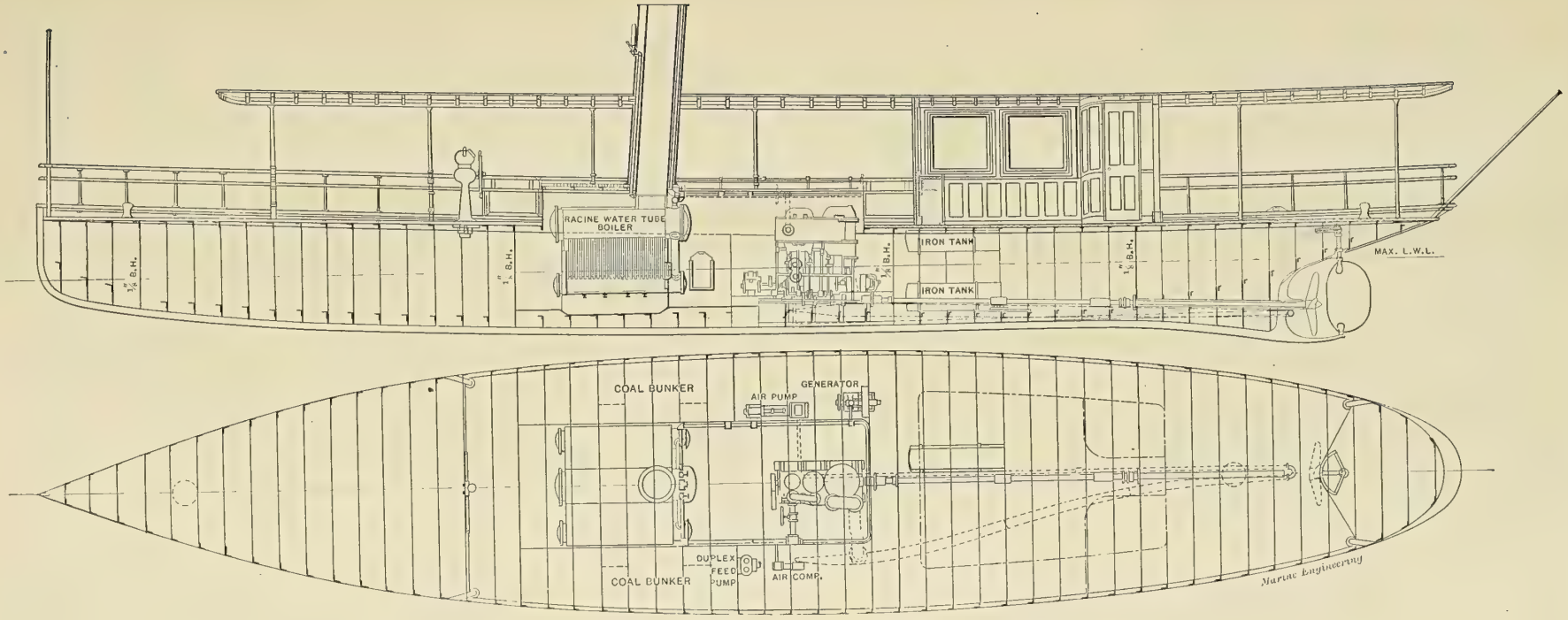
A STEAM YACHT FOR LAKE SERVICE.

The building of small steam yachts for cruising on inland waters is developing at about the same rate as that of our coasting yachts. The description and drawings of the 75-foot steel steam yacht *Louise* herewith presented are of a craft which represents a type of boat that has become very popular upon the lakes of New York State, and is designed primarily for a day boat. The vessel was built by the Racine Boat Manufacturing Company, of Racine, Wis., for Mr. John J. Mitchell, of Chicago, to be used by the latter gentleman on Lake Geneva, N. Y. The principal requirement was that there should be plenty of deck room, with the largest proportion of the same forward of the machinery. The deck house is usually placed aft of the machinery space and built entirely above the deck, but on this craft the cabin is placed aft and the entire deck forward is clear. As will be seen from the plans, a cedar standing roof extends from within 10 feet of the bow to the stern. The general construction of the vessel is given in the following paragraphs:

Keel.—To be of flat bar steel, 5 by 1 inch, scarfed to receive stem and stern post. Stem and stern to be of steel, rabbeted to receive plating, scarfed and riveted to keel in a workmanlike manner. Stern to have proper eyes for shaft and rudder.

Frames.—To be spaced 17 inches apart and to be of steel angles 2 by 1 1-2 inches, furnished to exact shape and punched to receive plating, floors, and reverse frames. Reverse angles to be of steel, 1 1-2 by 1 1-2 inches, used on each frame, and to extend 12 inches beyond curve of bilge, except in engine and boiler room, where every alternate one extends to sheer of vessel. Floors to be of steel plate 3-16 and 7-32 inch, securely riveted to frames and reverse angles. Deck beams to be of angle steel 2 1-4 by 1 1-2 inches, fastened to frames by means of gusset plates, and to be placed on each frame. Gusset plates of steel plate 3-16 inch thick amidships, 1-8 inch forward and aft, securely riveted to frames and deck beams.

Plating.—To be used as wide and long as shape of yacht will allow, so as to avoid laps and butts; all plates being lapped athwartships; all butts fore and aft to be flush. Garboard plate to be 1-4 inch thick, double riveted to keel, stem and stern, with 1-2-inch rivets. Sheer plates to be 7-32 inch thick amidships for one-half length of vessel, 3-16 inch forward and aft; to extend 8 inches on top of deck from bulwark. All other plates to be 3-16 inch for half lengths amidships, 1-8 inch forward and aft. Bulwark angle to be 1 1-2 by 1 1-2 inches, riveted to sheer plate. Riveting to be in a workmanlike manner, perfectly smooth on the outside, to be of either best Norway iron or mild steel. Keel, stem and stern, and all butts to be double riveted; the rest to be single. Deck stringer to be of 1-8-inch steel plate, 15 inches wide amidships, 10 inches forward and aft, and to be securely riveted to deck beams. Deck stringer angle to be 1 1-2 by 1 1-2 inches, riveted to sheer plate and deck stringer plate. Floor angles for hull forward and aft to be 1 3-4 by 1 1-2 inches, riveted to frame. Engine foundation to be of steel, constructed in such a way as to avoid vibration when engine is running at full speed.



PLAN AND ELEVATION OF STEAM YACHT LOUISE, BUILT BY THE RACINE BOAT MANUFACTURING COMPANY.

BULKHEADS.—Athwartships to be five in number and of steel plate 1-8 inch thick, stiffened with steel angles 1 1-2 by 1 inch, spaced not more than 24 inches apart.

RUDDER.—To be 5-16-inch steel plate, stock to be 2 1-4 inches diameter, forged to proper shape.

COAL BUNKERS.—On each side of boiler, of about three and one-half tons capacity, to be of steel plate 1-8 inch thick, stiffened with steel angles 1 1-2 by 1 inch, not more than 24 inches apart, and to have proper outlets to fire room and square gunmetal hatches in deck, one hatch to each bunker.

COVERING BOARD, or plankshеer, to be of sound white oak 6 by 1 5-8 inches, fastened with rivets to sheer strake and deck stringer plate.

DECK.—To be of selected, clear, well-seasoned, quarter-sawed white pine, free from sap, laid fore and aft, 1 1-4 by 2 inches, to be blind fastened and screwed from deck beam below, seams to be calked with cotton and filled with white lead. Deck hatches to be flush, 14 inches in diameter, of polished gunmetal, one forward and one aft, and fitted with grating and solid cover. Bulwark to be of best quality of white oak, 1 3-8 by 3 inches, fastened to rail angle from below with screws. Rails to be of mahogany, supported on brass stanchions, to have netting of best quality between and designed to suit owner.

SCUPPERS.—Main deck scuppers to be four in number, of 2-inch lead pipe, flanged at main deck and tacked down in white lead, lower end to be attached to plating 2 inches above the water line and made tight with a brass backing flange securely bolted to hull. Scuppers for upper deck to be two in number, located at lowest point of canopy top, and arranged to discharge into main deck scuppers located as shown on plans.

CANOPY TOP.—To be made light and supported upon turned stanchions of mahogany. Top to be covered with 10-ounce canvas and painted outside. Inside to be matched, of clear white pine, varnished. Head room between deck and canopy carlins, 6 feet 7 inches; carlins to be of selected mahogany.

CABIN.—To be 13 feet long and of such width as to give passageway either side on deck, to be of white pine, plainly paneled outside, and of Mexican mahogany with plain panels inside, including front of settees

and sideboard; to have French plate-glass windows; all windows to be stationary. Also stationary French plate-glass windows in each door and over sideboard. Top to be finished in white enamel and to have mahogany carlins. Cabin windows fitted with Pullman car curtains. Toilet room to be furnished like cabin and to have entrances from cabin, same to be furnished with one flush W. C.; also with porcelain bowl wash basin, with onyx marble slab and back; all plumbing to be open and nickel plated, and to be supplied with one 60-gallon capacity water tank and one 30-gallon capacity air tank, with Marsh steam air pump and gage. Settee in cabin to be upholstered with leather of the best quality, to be stuffed with best grade of curled hair. Sideboard to be arranged in forward end of cabin, to have drawers and lockers.

Steering Wheel.—Located about four feet from coaming, to give space for chair; constructed of mahogany, with brass trimmings on polished gunmetal stand, made hollow, fitted with bevel gears and Tobin bronze steering rod, with rack and pinion movement below deck, and quadrant on rudder. Bell pull and jingle bell to be arranged in stand.

Cleats and Chocks.—All necessary cleats and chocks, of proper size to securely moor boat, will be supplied and fitted in polished gunmetal.

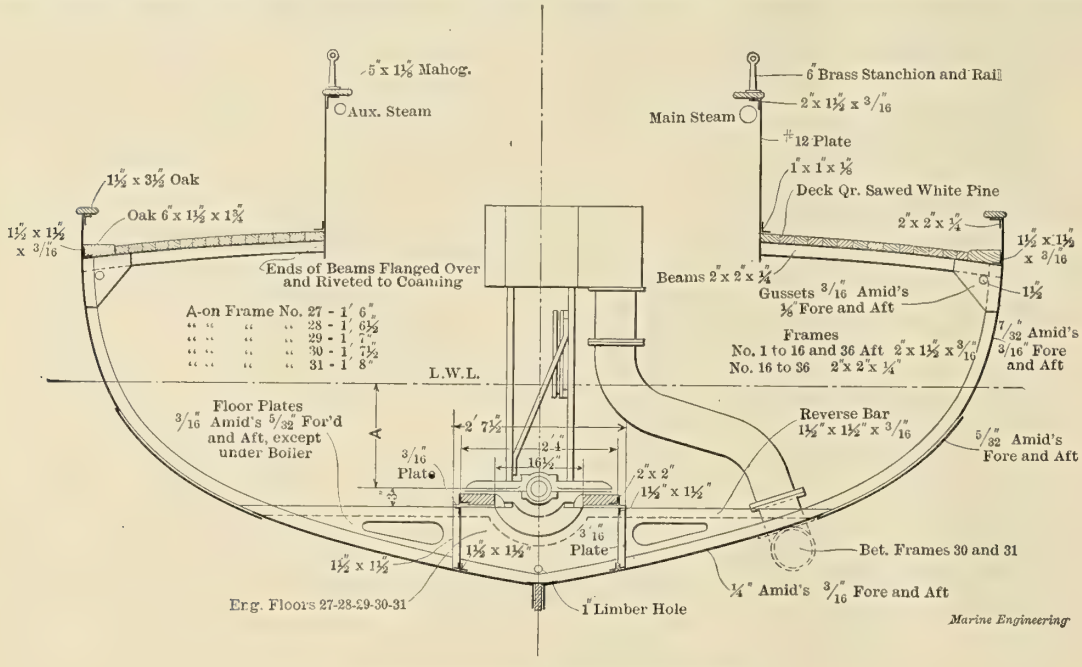
Anchor.—One 60-pound galvanized anchor with loose stock to ship below through flush hatch, and with suitable Manila lines.

Coaming.—Around engine and boiler room to be of steel plate. Top of boiler to be of steel plate, covered with a Mexican mahogany grating and lined with asbestos to enable it to be used as a seat if desired; a 6-inch brass rail to surmount mahogany rail on coaming.

Wales.—Or wearing strakes, to be of oak 4 inches wide, faced with 1-inch half-oval iron, securely fastened to hull at deck line and extending about two-thirds of length of vessel. To be tapered fore and aft and die away in lines of hull.

MACHINERY.

Boiler.—To consist of one Racine water tubular boiler, with bent steam generator tubes of seamless drawn steel, and to carry a working pressure of 250 pounds. The boiler will be about 5 feet square and have 19 square feet of grate surface and about 760 square feet of heating surface, and weigh about 4,000 pounds. Boiler to have ample air space between coaming, and coaming inside to be lined with asbestos. All fittings to be of extra heavy pattern, designed for 250 pounds pressure, and of the latest pattern. Boiler will be provided with triangular rolling grates and suitable shaker. Smokestack to be double, with 3-inch air space between each stack, constructed of No. 16 steel. Front head on boiler drum to be covered with large spun-brass head, with name of yacht engraved thereon.



MIDSHIP SECTION OF LAKE-BUILT YACHT LOUISE.

Engine.—To be of the triple-expansion type of the size mentioned in the table, and to be of the very best material and with spiral reversing gear. Frame of polished-steel stanchions, the cylinders to be of best quality gray cast iron, connecting rods of polished gunmetal, crank shafts of best quality mild steel forged solid, crank boxes of polished gunmetal babbited, gearings of steel castings babbited, bed plates of best quality bar steel planed all over, crossheads of polished gunmetal, stuffing boxes of polished metal, cylinders lined with polished brass lagging all around, polished spun-brass covers top and bottom.

Condenser.—An outside keel condenser, made of copper pipe with brass flanges of suitable size, will be supplied and fitted with all proper connections pertaining to a first-class job.

Pumps.—Air pump is of the Dean pattern, 4 1-2 by 6 by 5 inches, properly fitted and connected. Feed pump is a duplex, 4 1-2 by 2 1-2 by 4 inches, and is made by Worthington. An injector is also supplied.

Shafting.—To be of best quality of cold-drawn steel, 3 inches diameter, to be in two lengths, connected together with clamp couplings of cast steel. Line bearings to be of cast iron, babbited and properly secured in vessel. Stern bearings to be of gunmetal, babbited, to be made long enough to give good bearing. Stuffing box to be of gunmetal. The propeller is 40 inches diameter and of bronze.

Electric Lighting Plant.—To consist of one high-speed automatic engine, direct connected to a 25-light latest improved dynamo; lamps and fixtures to be distributed in accordance with owner's wishes, and the entire plant to be of modern design and of first-class pattern. Outfit to be complete with switchboard and instruments, also 50-C.P. incandescent lamp with reflector arranged on top of canopy for searchlight.

FINISH.

The hull to be treated inside to one coat of red lead paint and one coat of anti-rust paint. Outside to have one coat of anti-rust paint and two coats of our composite green below water line. On top of water, hull to be treated to five coats of best quality of white lead. Cabin house to have three coats of white lead outside, and all the hardwood to be rubbed down in oil and pumice stone and finished in the best manner. Bulwark and rails to be finished natural in best spar varnish.

Name—Louise Nationality—American Type—Steam Yacht

Launched—1902 Builder—Racine Boat Mfg. Co. Owner—John J. Mitchell

Length over all	75 ft.	Condens. surf. outboard pipe	50 sq. ft.
Length L. W. L.	68 ft.	Vacuum	21 in.
Beam, extreme	14 ft.	Speed	14.5 statute miles
Draft	4 ft.	**Boilers,** number	1
Corresponding displacement (fresh water),	22.28 long tons	Type	Racine water tubular
		Pressure	250 lbs.
Area midship section	24.8 sq. ft	Size	5 ft. sq.
Block coeff	.41	G. S.	19 sq. ft.
Engines, number	1	H. S.	760 sq. ft.
Type	3 cylinder, triple expansion	Weight	4,000 lbs.
Cylinders, diameter	6¾, 10¼, 16¾ in.	**Propeller**	4 blades, bronze
Stroke	9½ in.	Diameter	40 in.
I. H. P., on trial, estimated	140	Pitch	55 in.
R. P. M.	425		

CARE AND MANAGEMENT OF THE MARINE GASOLINE ENGINE.—III.

BY E. W. ROBERTS.

There is nothing about a gasoline engine that requires more attention than the igniter. For this reason it is absolutely necessary that the operator give this part of the engine his most careful study, as, nine times out of ten, gasoline engine troubles are igniter troubles. But two forms of ignition are used in marine gasoline engines—namely, the hot tube and the electric spark. Practically all of the marine engines built in this country use electric ignition, there being but one exception, to the writer's knowledge—that is, there is but one marine engine made in the United States using the hot-tube ignition.

In Fig. 12 is shown the principle of the hot-tube igniter. It is merely a tube closed at one end and screwed into the cylinder wall of the engine, with its open end communicating with the combustion space of the engine. This tube, *t* in the figure, is heated by a gasoline burner *d*, the flame being guided by chimney *c*, so that it heats the tube to redness at a point in its length which is determined by the time in the stroke

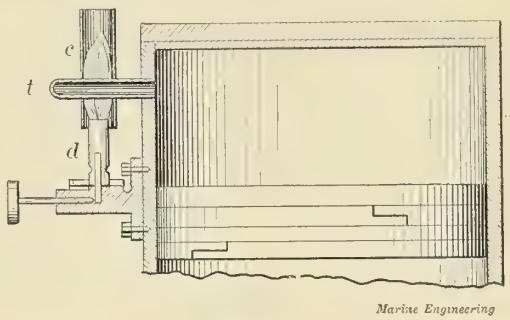


FIG. 12.

of the piston at which it is desired that ignition should take place. The most common form of tube igniter is that shown in the figure, and the principle of its operation is as follows: When the engine exhausts, it leaves the tube *t* filled with the products of combustion at about the pressure of the atmosphere. These prevent the fresh charge from reaching the hot portion of the tube until the charge is compressed to such a point that it drives the dead gas back in the tube past the heated portion and allows the fresh gas to come in contact with the igniting point, where it takes fire.

The time of ignition may be varied by changing the position of the flame on the tube, bringing it nearer to the open end, advancing the time of ignition, and *vice versa*. Again, shortening the tube will require a higher compression to drive the dead gases past the hot point and retard the ignition, while a longer tube will give earlier ignition. The tubes are made of ordinary gas pipe, of porcelain, of a special nickel-steel alloy, and also of platinum. The wrought-iron tubes last all the way from a few days to a few weeks, while the other substances mentioned may generally be relied upon to last for a season, or perhaps two. While cheap and simple, hot-tube igniters are generally considered troublesome and not suitable for marine engines, one great objection to their use being the necessity of

having an open flame on the exterior of the engine. In spite of these objections, the firm above referred to has been quite successful in their use, as is attested by the many operators of its engines.

Electric ignition, which is now so widely used, deserves the most careful study by the operator, and for this reason the writer will describe it in considerable detail. Two forms of electric ignition are used, one known as the primary make-and-break, and the other as the jump spark. The principle of primary ignition is as follows: If an electric circuit of any kind be suddenly broken, a spark will be formed across the gap. The nearest analogy to this is the thump that is heard upon the sudden closure of a hydrant, the sound resulting from the sudden stoppage of the stream of water. However, to better understand what really causes the spark, it is best to pass to the fundamental principles of electricity. Around every wire in which current is flowing there is a magnetic field similar to that around the poles of a magnet. If a conductor of electricity lies within the field of a magnet, any alteration in the intensity of this magnetic field caused by a corresponding alteration in the strength of the magnet will cause a current to flow in the conductor so long as the ends of the conductor are electrically connected. To return to the broken circuit, it will be seen that when the circuit is broken the magnetic field caused by the current flowing in the wire will immediately disappear. Now, since an alteration in a magnetic field about a conductor will produce a current in that conductor, it would seem that breaking the circuit would have a tendency to produce another current, and this is just what occurs. Further, this current is of so much greater pressure than that originally flowing in the wire that it will cause a spark to leap across the gap at the first instant of the break and before the gap is very wide.

The voltage—or, in other words, the pressure—of a current formed by the alteration of the magnetic field is in proportion both to the strength of the field and the rapidity with which the change is made. Thus, if the field is very strong and is rapidly diminished to zero, as by breaking a powerful circuit, the spark produced would be very much more intense than if the field were weaker or the break very gradually made. By winding a conductor about a core of magnetic metal such as iron, the magnetic field produced by the current is very much increased. Hence the reader will readily see that if an electromagnet forms a part of the circuit which is broken, the intensity of the spark will be very much increased.

In Fig. 13 is shown such a circuit supplied by a current from the battery of four cells *c, c,* flowing through the electromagnet or spark coil, a switch *s,* and a pair of igniter points *i,* returning thence to the battery. The spark coil consists of a number of coils of insulated wire *b,* wound about a bundle of fine iron wires forming the core *a.* The igniter points are separated at regular intervals by a mechanism on the engine, to be explained later, and, owing to the strong magnetic field of the coil, which is thus suddenly changed from its maximum to zero, a current of very high pressure is momentarily induced in the circuit and an intense spark is made at the break.

Ordinarily the igniter points are separated and brought together but a moment before the time required for the spark, in order that a current may not be flowing continuously through the circuit and thus waste the energy of the battery. For this same reason the switch *s* is introduced in the circuit in order that the current may be turned off entirely when the engine is not in use. Occasionally the mistake is made of not bringing the igniter points together a sufficient length of time before the spark to give the best effect. Every spark coil requires a definite, although short, interval of time to become fully magnetized. As the intensity of the spark depends directly upon the strength of the magnetic field, if the field has not time enough to build up, the spark will be weakened in consequence. Short coils become magnetized more quickly than long ones, but require a little more current for the same magnetic strength than the long coils. Hence a short coil should be used for a high-speed engine, a 6-inch coil being that most generally employed for the modern marine engine.

Failure of the igniter to operate may be due to one of several causes, and occasionally to several combined. In the first place, the circuit may be broken either by a connection becoming loose or a broken wire. Quite often the wire will break inside the insulation or cov-

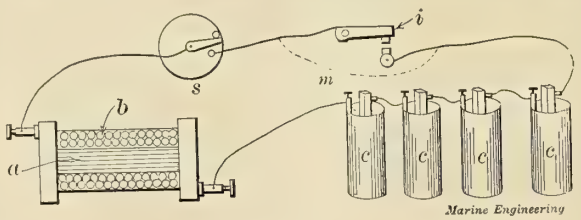


FIG. 13.

ering, and to all outside appearances be perfect. This can be discovered by using another wire and bridging around that which is supposed to be broken. A careful inspection of the connections will show whether the fault is in them. A very annoying fault is a loose connection which is in contact so long as the engine is idle, but which is jarred out of position by the vibration of the engine when it is running. Poor contact is very often produced by corrosion or by the igniter points not being pressed firmly enough together. Occasionally there is a shunt, as indicated by the dotted line at *m,* Fig. 13, which allows the current to flow past the igniter when the break at the igniter points will not produce a spark. This may be tested by noting if the circuit is complete when the igniter points are held apart. If current is still flowing, it indicates a shunt, which is quite often the fault of the insulation of the stationary igniter point. Another fault is a weak battery, which can be determined by bridging the terminals of the cells with a piece of wire and scraping one end of the wire across a terminal, when a slight spark should be given if the cell is in good condition. This test may also be made by bringing the ends of the two wires connected with the cell terminals in close proximity on the tongue, when the current will be felt. A still better method is to use a small voltmeter, called a battery tester, which will indicate directly the strength of the

cell. If but one cell is at fault, it may be cut out by bridging with a piece of wire, and quite often the engine may be run for a short time with the remainder of the battery.

In Fig. 14 is shown one of the simplest forms of the make-and-break igniter, usually called a piston igniter. The terminal *i*, usually called the insulated electrode, is provided with a mica bushing *m* and two mica washers *n*, which prevent it coming in metallic contact with the engine. A rocker arm *r* rotates in a sleeve *s*, being held normally in contact with *i* by means of the spring *a* on the outside of the engine, one end of the spring being fast to the clip *c* on the shaft of *r*, and the other end being fast in the outer end of the sleeve *s*. As the piston approaches the end of its stroke, the pin *p* strikes the arm *r*, separating the platinum points *b*, thus breaking the circuit and producing a spark between the points. In the form shown, the current passes to the arm *r* from the engine itself, one terminal of the circuit being attached to any convenient point on the engine, the current flowing through the metal. This is called grounding one side of the circuit and is customary in practically all forms of gas-engine igniters. Such an igniter has

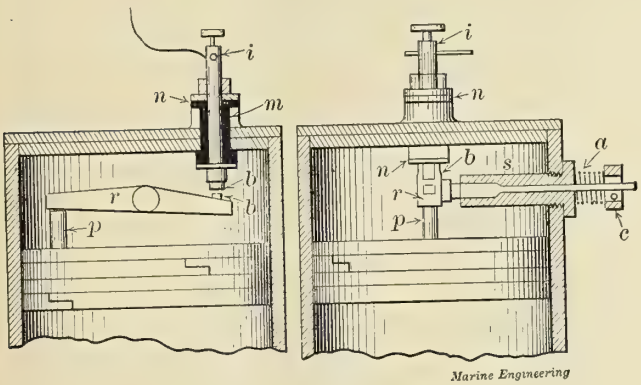


FIG. 14.

the circuit closed, except from the moment of the break to the time the pin *p* releases the rocker arm. Quite frequently a circuit breaker is provided, which is attached to the crank shaft on a two-cycle engine, or to the cam shaft on a four-cycle engine, the circuit being closed just long enough before the break to allow the spark coil to pick up. If the circuit breaker is not used, a dynamo should be employed to provide current sufficient for the igniter, as it will very soon run a battery down.

In Fig. 15 is shown the outside mechanism of an igniter which is operated from an eccentric and closes the circuit only long enough before the break to charge the spark coil. The rocker arm has a lever *l* on the outside of the cylinder, which is held against the stop *h* by means of the spring *s*, so that the electrodes inside the cylinder are separated. The eccentric rod *p*, coming in contact with *l*, forces the electrodes together, and after the points meet further movement of *l* compresses the secondary spring *k*. The arm *l* rotates freely about the rocker shaft, and the arm *m*, being fast to the rocker shaft, is moved only through the spring *k*. As the eccentric rotates in the direction of the arrow, the lower end of *p* is carried to the right, consequently the upper end passes to the left until *l* slips off and flies back against the stop. The spring *k* and the arm *m* are carried with it, and the circuit is broken with a snap. Further rotation of the eccentric draws *p* downward, the upper end passing far enough to the left to clear the end of *l*. There are quite a number of igniters that operate on this general principle, and all of them bring the electrodes in contact for a short time only, thus avoiding waste of the battery.

Another variation of the make-and-break is what is known as the wipe spark, and is illustrated in principle in Fig. 16. The stationary insulated electrode *s* is provided with a spring, and the movable electrode *m* rotates once for one cycle of the engine. It is provided with a lug *l*, which comes in contact with a spring *s*, deflecting it until finally the spring snaps off the lug and a spark is formed. This igniter has several objectionable features. The spring will not hold its tem-

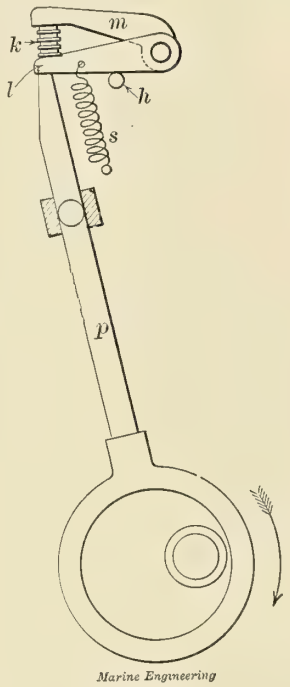


FIG. 15.

per when exposed to the high temperature of the combustion in the cylinder, and, if the spring be placed outside, the movement of the arm in the insulation is inclined to displace it. The principal objection, however, is the rapid wear of the contact, owing to the rubbing. It is absolutely necessary to devise some means of feeding the spring as it wears, and this necessitates constant adjustment and interferes with the timing of the spark.

The jump-spark igniter owes its development to the automobile, for which it has been adopted principally because there are no moving parts in the engine cylinder, and therefore it is better adapted to the high speeds in use on that form of engine. It is gradually finding favor among marine engine builders, and the writer knows of one manufacturer who is using it exclusively, this year being his second season with this form of igniter, and he reports excellent success with it.

If around the spark coil employed in primary ignition and on the outside of the coarse wire winding there

be wound another coil of very much finer wire, the rapid change in the intensity of the magnetic field caused by a break in the primary circuit will also induce an impulse in the fine wire winding corresponding to that which makes the spark in the primary igniter. Owing to the very great number of turns of the fine wire, the pressure of this impulse is very great, while the intensity of the current is very small. The high voltage or pressure of this fine or secondary winding is sufficient to overcome the resistance of an air gap, over which it will cause the current to pass, making a spark as it does so. The pressure derived may be better realized when it is known that a pressure of about 20,000 volts is needed to cross an ordinary air gap of about one inch. Jump-spark coils for gas engines are usually made so that they have sufficient voltage in the secondary to spark across a gap of from a half inch to one inch. The normal sparking distance for the engine, however, is about 1-32 inch.

In Fig. 17 are illustrated the circuits for a jump-spark system of ignition. The Ruhmkorff or, as it is generally called, "jump-spark" coil is shown at the left of the figure. As with the coil shown in Fig. 13, it has a soft iron core *a*, about which is wound the primary winding *p*, through which the current flows from the battery of cells *c*, *c*, and around this coil is wound a secondary of fine wire *s*. The primary circuit is broken at the proper time in the circuit by means of the cam *k*, having a notch, as shown, into which the knob *g* is forced by the spring *h*, allowing the platinum points *n* to come together, closing the circuit through the coil *p*. The usual form of jump-spark coil is provided with a magnetic vibrator in circuit with the primary. This vibrator consists of an iron armature *j*, mounted on a brass spring *i*, which is attracted by the core *a* as soon as it is magnetized, and, drawing *j* toward it, breaks the circuit at *f*; when *j* is released the circuit is closed, and the former operation is repeated just as in a vibrator on an electric bell. This vibration sets up a series of magnetic oscillations in the core *a* and increases the effect on the secondary circuit, making a more intense spark than would be produced by a single break in the primary.

The terminals of the secondary are, one of them, grounded on the engine and the other connected to a highly insulated electrode *e*. This electrode is held in a plug *m*, which is screwed into an opening into the combustion space of the engine. Riveted into the edge of the plug is a bent platinum wire *w*, which is curved toward the central electrode *e* so that there is a gap of 1-32 inch between them. The terminal *w* is in circuit with one end of the secondary winding through the wall *m* of the plug and the grounded wire. When the circuit is closed at *m* a series of sparks are produced at the gap of the plug, which continue until the points *n* are separated. As in the circuit shown in Fig. 13, the tendency is to produce a very hot spark at both *f* and *n*, and in order to reduce this spark an electric condenser *x* is connected across the gap *f*. The condenser consists of layers of tinfoil, between which are placed sheets of oiled paper. There is no metallic contact between the layers of tinfoil, which are connected to the opposite sides of the circuit, but the condenser absorbs a portion of the impulse produced by the break and reduces the volume of the spark, thereby increasing the life of the platinum points.

Ordinarily the coil described will not give a sufficient spark for ignition with a single break in the primary, but by the use of a special winding the vibrator may be dispensed with, and an igniting spark will be given at the plug each time that a circuit is made and broken through the primary at the points *n*. With this form of coil the cam *k* should be so set that the points *n* *separate* just at the time a spark is necessary at the plug.

The points *n* and the spring *h* are attached to a block of fiber *d*, which may be rotated around the cam *k*, changing the time in which ignition takes place. Rotating *d* in the same direction as *k* rotates retards the ignition, and *vice versa*. This method of changing the lead of the ignition is very convenient, and the fact that there are no moving parts of the igniter in the cylinder or attached to heated portions of the engine are points in favor of the jump spark. For multiple-cylinder engines two methods are employed, the most usual one being to make the number of coils and the number of pairs of contacts *n* equal to the number of cylinders. The latest practice, however, is to use one coil and to commute the secondary current so that it is in circuit with but one plug at a time. In this case the cam *k* has a number of notches equal to the number of cylinders.

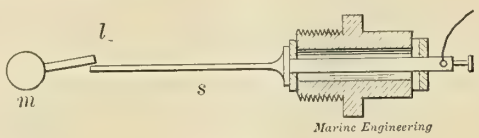


FIG. 16.

In addition to the troubles experienced with the primary igniter, the jump spark has troubles peculiarly its own. The high pressure of the secondary circuit requires high insulation to keep it within proper bounds, and it is customary to cover all the secondary wires with rubber tubing. Carbon is apt to bridge across the terminals of the plug, causing it to short-circuit, so that no spark is formed; the insulation of the plug will sometimes break down, or the plug may be short-circuited itself by moisture either in the insulation or on its external surface. A moist plug may be dried most rapidly by dipping it in gasoline and setting fire to it, of course the plug being removed from the cylinder for this operation. Deposits of carbon are due to excessive lubrication, which should be avoided. However, a plug that is inserted directly in the path of the incoming gases is less inclined to foul than if placed anywhere else. Another scheme to avoid the carbon bridge is to insert the plug at the end of a nipple about half an inch long, thus placing it in a small pocket. This latter scheme was recommended to the writer by an experienced automobile operator, but he must admit that he has given it no trial himself, and so cannot say whether it will dampen the spark or not. The user of the jump spark should watch his plugs carefully and clean the points frequently. He should also watch the contacts *f* and *n*, see that they are always bright and make good contact. The spring *i* should never be allowed to

hammer against the end of the core *a*, but the contact screw should be so adjusted that *i* will move freely, as close to *a* as practicable without touching it.

Current is supplied to both forms of electric igniters by means of either a dynamo or one of various forms of batteries. The dynamos are of various kinds, some of them with permanent magnets and of the variety known as magnetos, while others have electromagnets for their fields, excited by their own current and called self-excited machines. In the later forms of these machines they are supplied with an automatic governor, which keeps them from running above a certain speed, as high speed both increases the wear and raises the electrical pressure. Quite often these dynamos are used in conjunction with a storage battery, the battery being used to start the engine and as a reserve in case the dynamo goes wrong. The battery is so arranged that it can be charged by the dynamo at the same time it is furnishing current for the igniter. Sometimes a battery of storage cells is used alone and, as it runs down, charged occasionally from an external source.

Many forms of primary cell are used, a great many of these being of the zinc and copper-oxide type, in which the fluid, known as the electrolyte, is a solution of either caustic potash or caustic soda, most generally the latter. The ordinary bell "battery," with terminals of carbon and zinc and a solution of sal-ammoniac for the electrolyte, will, as ordinarily made, not give good satisfaction for gas-engine igniters. However, some of the latest forms of this cell are so constructed as to adapt them for gas-engine use, and in the "dry" form they are quite convenient for boat use. The reader is advised to make sure that he gets the form of cell which is made expressly for a gas-engine igniter. Four sal-ammoniac cells or five cells of the caustic-soda type are sufficient for operating an igniter of either the primary or the jump-spark type. Two batteries of a suitable number of cells each should be installed in a boat, with a switch so wired to them that either one or the other may be thrown in at the will of the operator, for a battery is apt to give out unexpectedly and at any moment. The launchman should always take with him on a trip spare igniter parts, particularly springs and electrodes, or, if he uses a jump-spark igniter, he should invariably have a full set of spare plugs, and it is also a good plan to have a spare coil if a long trip is contemplated. In connecting up a primary igniter for a multiple-cylinder engine, it is considered the best practice to use a separate battery and a separate spark coil for each cylinder of the engine, although the writer's experience indicates that it is sufficient to provide a battery for each two cylinders and a spark coil for each one.

(To be continued.)

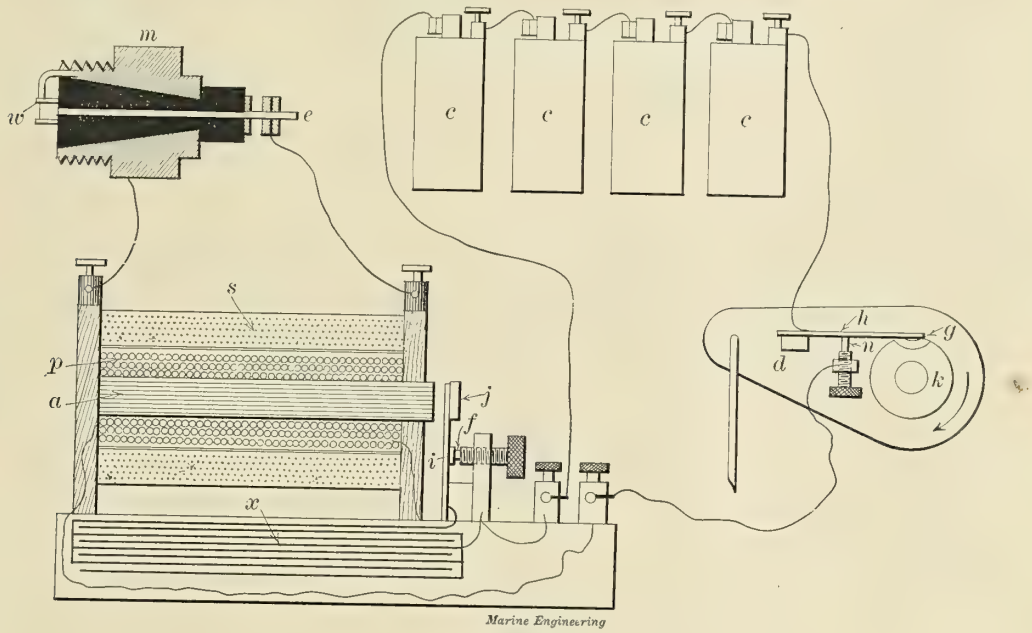
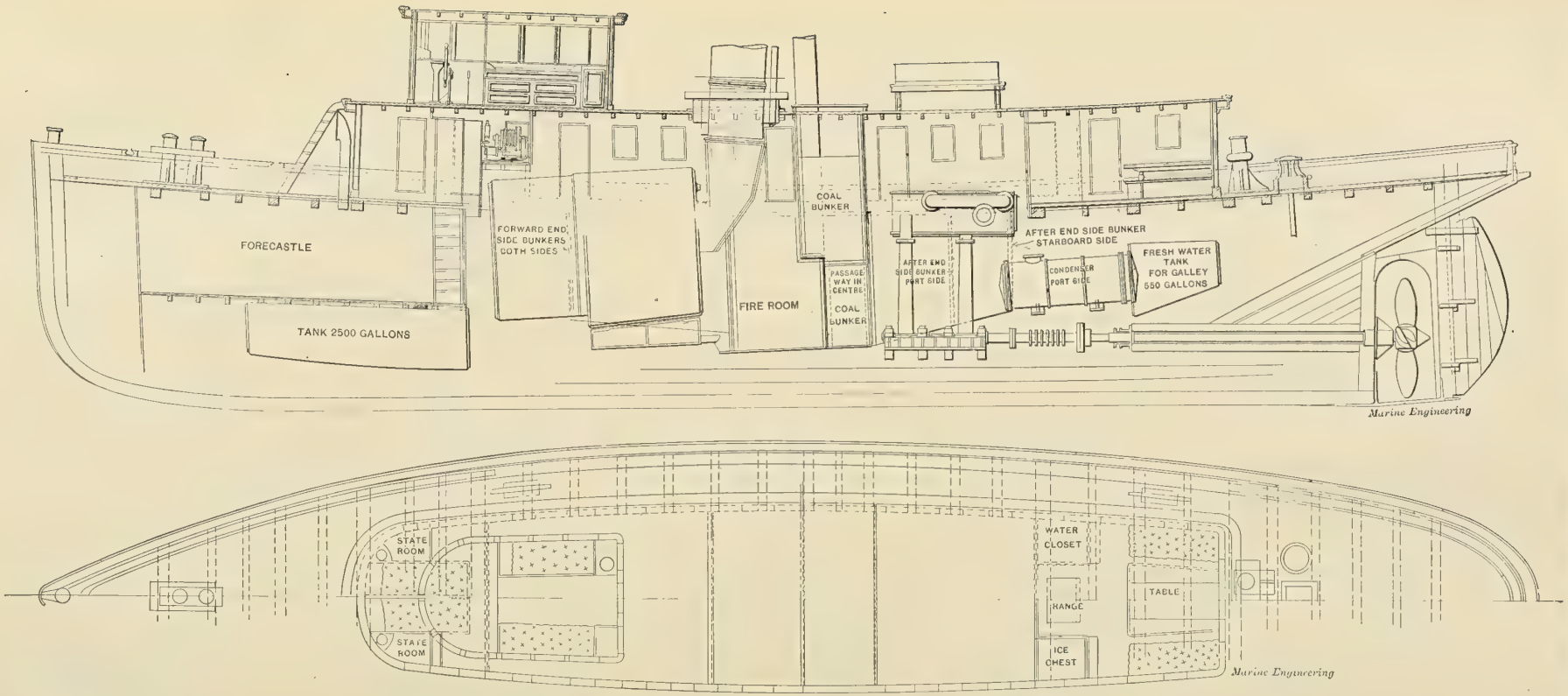


FIG. 17.

Bermuda Dry-dock.—The new Bermuda dry-dock, built by Swan and Hunter at Wallsend-on-Tyne, has been towed to its station in Bermuda. Before leaving the other side, for the purpose of testing this dock, the British battleship *Sans Pareil* was docked by it.

United States Shipbuilding Company.—Through the Trust Company of the Republic of New York, $9,000,000 first mortgage, thirty year, 5 per cent. bonds have been subscribed for the United States Shipbuilding Company. The following plants have been acquired by this company: The Union Iron Works, San Francisco, Cal.; The Bath Iron Works, Ltd., and the Hyde Windlass Company, Bath, Me.; The Crescent Shipyard and the Samuel I. Moore Sons' Company, Elizabethport, N. J.; Eastern Shipbuilding Company, New London, Conn.; The Harlan and Hollingsworth Company, Wilmington, Del.; and the Canada Manufacturing Company, Carteret, N. J. These plants have been appraised at about $20,000,000, and have at present under construction work amounting to about $36,000,000. The bonds above referred to are a part of an issue of $16,000,000, for which $5,500,000 are withdrawn from public issue, to provide cash working capital for the company.



LONGITUDINAL SECTION AND PROFILE OF TUGBOAT JOHN G. CHANDLER, DESIGNED BY MESSRS. KEOUGH.

NEW BOSTON TUGBOAT.

A vessel whose appearance in Boston waters is looked forward to with much interest is the new tug *John G. Chandler,* now building for the Commercial Towboat Company, by Kelley and Spear and the Bath Iron Works of Bath, Maine, from the designs of Richard F. and William T. Keough, of East Boston.

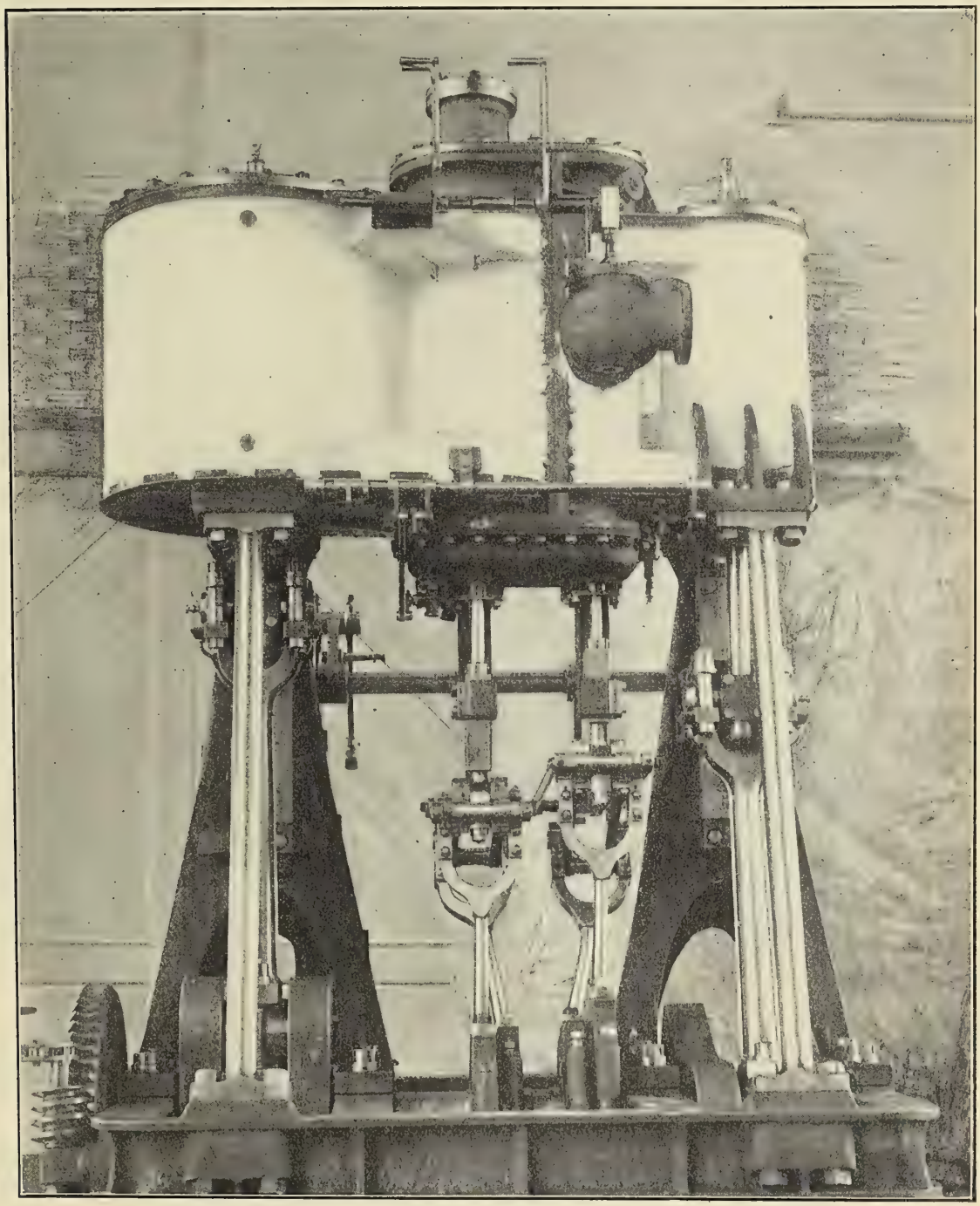
With the increase in size of coal barges and five-and-six-masted schooners has come a demand for harbor tugs of suitable size and power to tow them up from the bay and place them in their berths at the coal wharves. The need of tugs of this type is illustrated when one of the six-masted schooners, like the *Eleanor S. Percy,* sometimes requires four or five tugs of the old-fashioned type to place her in her berth.

The new tug is built of wood; the stem, keel, stern post, and outboard planking being of white oak, the frames of white oak and hackmatack, the ceiling and beams of yellow pine, and the deck and deck houses of white pine. There is a very large forecastle, in which are the quarters for the crew, and abaft the machinery is a very roomy lazarette for the stowage of hawsers, equipment, etc. A large and roomy deck house is fitted, in the forward end of which are two state rooms for the officers. Next in order come a steam steerer room, boiler room, engine room, galley, and mess room. In the after end of the pilot house is a large state room for the captain. There will be two metallic lifeboats and all the equipment and outfit of the most complete modern tug.

The machinery is to be of the most modern design and construction. The main engines are of the vertical inverted compound type with independent pumps. The air pump is to be of the vertical twin type, the circulating pump of the centrifugal type, and the main feed, auxiliary feed, bilge, sanitary, and boiler circulat-

ing pumps are all of the vertical duplex type. An inspirator and an ejector will also be fitted, and there will be a steam steerer and a steam hawser engine.

The boiler is of the firebox flue and return tubular type, built for a working pressure of 125 pounds per square inch. The front connection is outside the boiler and connects with a single smokestack 30 feet high above the upper deck. The tanks and coal bunkers are both built of steel, the former with a capacity of 3,500 gallons of water, and the latter 40 tons of coal.

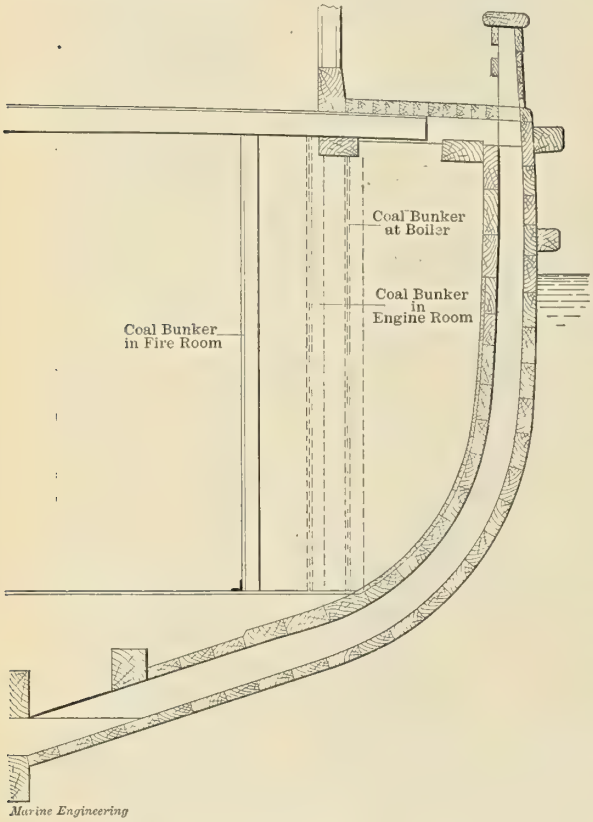


COMPOUND ENGINE BUILT BY THE BATH IRON WORKS FOR THE TUGBOAT JOHN G. CHANDLER.

It will be seen from the description that the new boat is much larger and more powerful than any of our harbor boats; but by means of the use of steam for steering, it is expected that she will be able to do all that is required of a boat of that class. In addition to her usefulness as a harbor tug, she is of sufficient power and coal capacity to hold her own with almost any of the ocean-going tugs hailing from the port in towing barges to and from the coal ports. Heretofore the ocean-going tug has been found too long for satisfactory service in harbor work, and the harbor tug has lacked power and coal endurance for coastwise work. This

is the first attempt in this vicinity to combine the two types in one, and the result is awaited with much interest.

The principal dimensions are:
Length over all, 102 feet.
Beam, over plank, 20 feet.
Draft, loaded, 11 feet 4 inches.
Engines, number, 1.
Type, compound condensing.
Cylinders, diameter, 15, 34 inches.
Stroke, 22 inches.
Length of engine room, 11 feet.
Boilers, number, 1 firebox flue and return tubular.
Diameter, 9 feet 6 inches.
Length, 14 feet.
Condensing surface, 800 square feet.
Propeller diameter, 8 feet.
Pitch, 10 feet 6 inches.



MIDSHIP SECTION OF THE JOHN G. CHANDLER.

By an ingenious distribution of the weights the designers have succeeded in arranging to have the draft remain practically at a maximum throughout the coal endurance of the boat, the importance of which every experienced towboat man will appreciate.

Both boiler and engines were made by the Bath Iron Works, Bath, Me.

Oil Steamers.—There was recently launched at Newcastle-on-Tyne an oil carrier named the *Pure Oil* and built for the Pure Oil Company of Philadelphia. The vessel has a carrying capacity of 6,000 tons and is for the transatlantic trade.

New Rules of the United States Standard Register of Shipping.

Rules for classifying wooden or steel vessels in the United States Standard Register of Shipping, New York city, have just been published and are in many ways a decided improvement over the previous rules of this association, as they have been extensively revised and enlarged to meet the demands of the present large shipbuilding practice.

The work of building a vessel according to any set of rules is in itself sufficiently tedious because of excessive proportions or from the fact that it may be built for especial service. It has evidently been the object of the compilers of the new rules to tabulate wherever possible scantlings covering all requirements, and, therefore, a most comprehensive set of tables is given, while the reading matter is so subdivided that the clauses governing special cases may be readily found.

Sections covering the classification and survey of vessels are practically the same as in the previous rules. The classification of vessels intended for sound, bay, and inland navigation will be especially considered. The paragraph on keels has been improved by dividing into six subheadings—Bar, Through Plate, Flat Plate, Continuous Center Line, Intercostal Center Line, and Center Line Single Plate Keel standing on the top of the floors. An improvement is also found in the paragraph on Stem and Stern Posts, a subheading being also given for Propeller Posts. The riveting for all members is tabulated under exhaustive tables, where will be found the diameters of rivets and spacing in inches for all classes of riveting in hull construction.

The paragraphs on Frames, Reverse Frames, and Floor Plates have been rewritten, and in the latter is a paragraph concerning the thickness of flange plates where used for floors. To meet the requirements of modern construction, the rules governing keelsons and stringers have been entirely recast and divided under the headings, Side Stringers, in connection with ordinary framing, in connection with web frames, and in connection with deep frames. Under Hold Beams and Stringers are given the rules for wide-spaced beams, and the depth of these beams for different size vessels is also stated. The subjects of Web Frames, Bulkheads, and Hatchways are also dealt with in a clear and concise manner. Owing to the new type of rudder generally adopted since the last set of rules appeared, the rules governing this member are new.

As previously stated, wherever possible reference is made to complete tables, which form a most valuable part of this book. In table 1 are given the scantlings, according to the tonnage by rule, of keels, stem and stern posts. It should be noted that, owing to the improvement of material, some of the scantlings have been cut down. Table 2 contains the scantlings of frames and floors; table 3 the shell plating, which is practically the same; in table 4 are given the dimensions of beams, of angle and channel section when supported by one, two, and three rows of stanchions; and in table 4A is given a list of equivalent beams.

In table 7 dimensions of the various members of the center keelson are given for the length of ships up to 620 feet. In table 8 are given the dimensions of bilge

and side keelsons and side stringers. Stringers for various lengths and breadths are given in the very complete table No. 9, which occupies no less than eight pages.

As previously stated, the dimensions for all kinds and sizes of riveting are reduced from rule to an elaborate table. The spacing of the rivets for the various kinds of laps and straps is given in inches for each thickness of plate, also the riveting for butts and the breadth of straps and laps. Table 11 contains the scantlings of the double bottom, and in No. 12 are given the dimensions for anchors and chains.

The succeeding pages of the book are devoted to sections of special types of vessels not covered by the rules, and indicating the construction acceptable for classification, and the remainder of the book is devoted to a register of United States shipping. By using this book in getting out the scantlings of vessels, it will be found that the work will be much simplified, as the rules have evidently been prepared by men acquainted with the requirements and the art of shipbuilding.

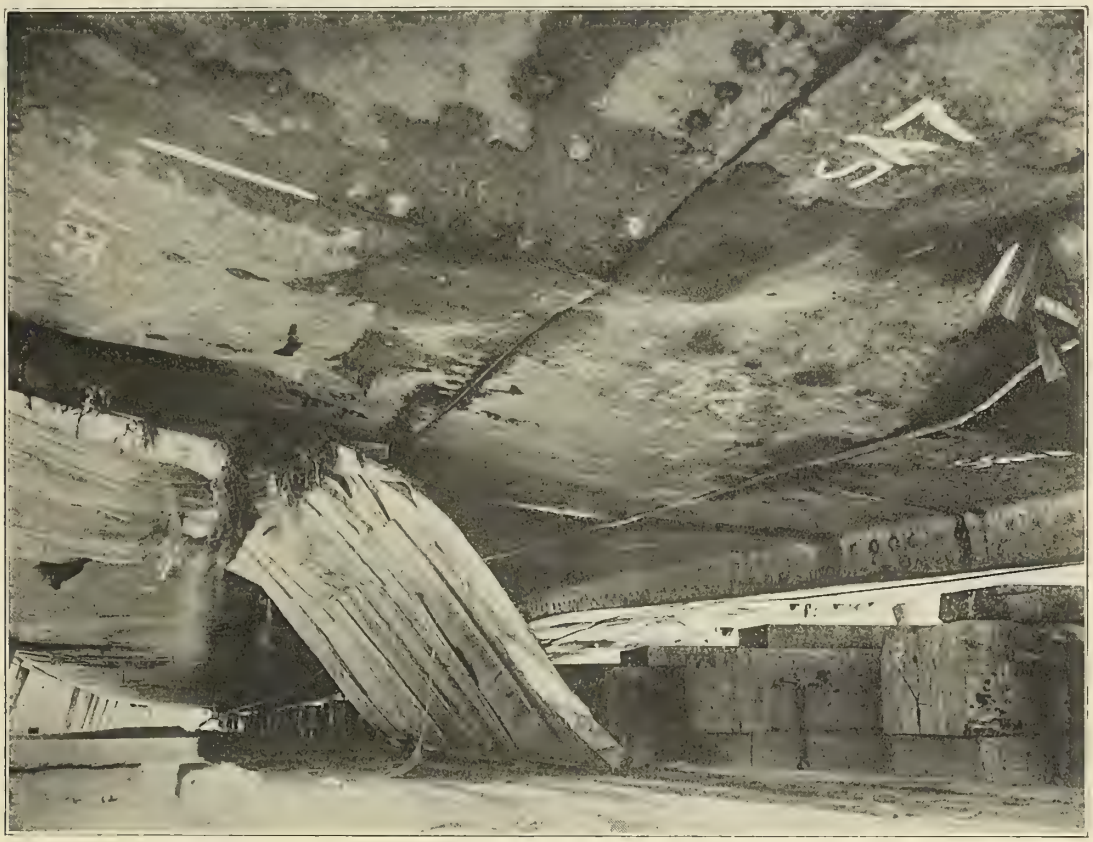
New Battleships.—Secretary Moody has selected the New York Navy Yard as the one in which to build one of the first-class battleships provided for in the last naval bill. It is decided that the $175,000 appropriated by Congress for preparing a navy yard to carry out large Government work could best be utilized in the New York yard.

Saving the Indian.

Editor of Marine Engineering:

I am sending you a few views of the wreck of the S. S. *Indian* on Sow and Pigs ledge. She came on there in a thick fog on March 29, 1902, and, as there was a heavy swell at the time, her bottom was soon full of holes and the ship full of water. The life-saving crew of the island took the passengers and crew off, after lying by her a long while waiting for a chance to get alongside.

The Boston Towboat Company took the job of floating her, and took out as much of her general cargo as possible, sent divers down and fixed what holes in her bottom that they could get at, and then put on board ten steam pumps and tried to pump her out; but it was of no use, for her entire bottom was full of big holes. They then went to work and boarded up the hatches of the lower deck, the divers taking down one plank at a time and putting it under the combings of the hatch. This was a long job, for when it got rough outside the swell inside would wash the plank away, which shows in what condition her bottom was. They finally got the plank all under and fastened; then they weighted the regular hatches with pig iron and put them on; and covered the whole with heavy canvas, and boarded that over. Stanchions of 6 by 6 inches yellow pine were then put in all around the hatches and all over between decks. They then went to work with their ten steam pumps and pumped the water out down to that deck and pulled her off the rocks. A good many people



BOTTOM OF THE STEAMER INDIAN, SHOWING SOME OF THE DAMAGED PLATES.

thought the deck would burst and let her sink, but it held, and she was towed to Vineyard Haven for further repairs. The work on her took just seven weeks, with three tugs and two lighters in attendance. This is the first steamer ever floated off Sow and Pigs ledge, although many have gone on there.

W. A. Charles.

THE STEAMER INDIAN, ASHORE OFF THE MASSACHUSETTS COAST.

ton Dry-Dock and found that 170 plates were damaged, the frames and floors for practically the entire length of the ship were broken and damaged, the stern frame bent, propeller gone, and the cabins and decorations were more or less damaged. The machinery will have to be thoroughly overhauled, although it is not seriously injured.

LIGHTERING THE CARGO OF THE INDIAN.

The contract for repairing the *Indian* was awarded the Erie Basin Dry-Dock Company, New York, whose bid was $30,000, the repairs to be completed in thirty-one days.

A Board of Surveyors inspected the ship at the Bos-

New Ferryboats.—Two new ferryboats are to be built by John Dickie and Company, of San Francisco, for the Southern Pacific service on San Francisco bay. The boats will have three decks and will cost about $175,000 each.

MODERN SHIPWAY EQUIPMENT, AND ITS FUTURE DEVELOPMENT.—II.*

BY TJARD SCHWARZ.

Again, if the boom is arranged to give a variable reach, much complication is added to the operating mechanism. Further, the foundation and the balancing of the crane for stability both present difficult problems, and the reach is thereby somewhat restricted, as well as movement relative to the dock front. The 100-ton derrick crane of Blohm and Voss in Hamburg, designed and constructed by the Duisburger Company, shows improvements in these directions, inasmuch as the reach may be increased up to 100 feet, while due regard has been paid to the movement relative to the wharf. A crane designed and constructed by the Harkort Company in Duisburg is provided with two separate sets of hoisting gear, for loads of 100 tons and 30 tons respectively. Further, each gear is arranged with two speeds, giving the following values:

HEAVY GEAR.

Loads up to 50 tons	8.5	ft. per mt.
Loads 50 to 100 tons	4.25	" "

LIGHT GEAR.

Loads up to 10 tons	40	ft. per mt.
Loads 10 to 30 tons	13	" "

Both hoisting gears are operated by a two-cylinder steam engine of 9 1-2 inches diameter and 18 inches stroke, making 180 revolutions per minute.

In order to obtain the highest possible efficiency of operation the use of worm gearing and bevel gears has been avoided, and only cut spur gearing has been employed in the apparatus. Furthermore, all parts of the hoisting gear direct are made of special size and strength. In both gears a single lead of the steel rope has a guaranteed strength of 100 tons, while in the large gear the load is carried by eight such and in the two small by four. In both gears the turning parts are carried in ball bearings, and all movements are thus readily executed.

The reach of the crane is under the control of the operator and may be varied between the following limits: For the large gear, between 56 feet and 94 feet; for the small gear, between 59 feet and 107 feet. In this connection it should be remarked that the small gear is capable of carrying a load of 30 tons at its maximum reach, while for the large gear the maximum load of 100 tons is not intended to be carried beyond a reach of 65 feet. If, then, it is remembered that the pivoting center of the crane is only 8 feet from the edge of the dock, it follows that the maximum reach of the crane is $107 - 8 = 99$ feet.

The boom has the form shown in the figure. Movement is given to the boom by a second steam engine of 8 1-4 inches diameter of cylinder and 12 inches stroke, which may also, if need arise, be coupled to the hoisting gear. For bringing about the variation in the reach use is made of two screws of Siemens-Martin steel. The pitch of the thread is such that the boom loaded may be safely left at any position desired. In addition to this a self-working brake is attached in such manner as to provide against any undesired movement which might arise due to jar, etc.

The horizontal forces in the boom are carried in a simple manner by the steel pins, as shown in the cut. The severe conditions to be fulfilled imposed upon the designer the need of making special provision for carrying the vertical load. The enormous weight to be carried and the restricted ground area, about 14.5 feet in diameter, forbade the use of the usual ball or roller form of support. For these reasons a form of circular track was selected. Through the choice of suitable materials with special means for lubrication, in connection with the greatest possible care in construction, the design has been highly successful, and the actual loss through friction has been less than as indicated in the preliminary computations. The turning speed of the boom, measured at the small hoist with its greatest reach, is 100 feet per minute with 180 revolutions per minute of the turning engine.

For bringing steam to the steam engines a special boiler is not necessary, as the boiler house of the Blohm and Voss yard is situated near the crane. The common pipe for both engines is carried through a stuffing box in the geometrical axis of the boom, and delivers steam of 60 to 90 pounds pressure. The crane as a whole is operated by one mechanic, who is placed in the forward part of the boom and at an altitude of about 23 feet, from which place the field of operation of both hoists may be plainly seen. Furthermore, as a protection against storm, the steam engines, the operating mechanism, and the stand of the operator are covered with an iron protective house. This is roomy and well provided with numerous windows.

For the turning support of the crane the box-like connections of the foundation form an extraordinarily strong construction, and it is especially noteworthy that the demands in connection with the three foundations are most satisfactorily met. The middle foundation block under the boom experiences only a vertical load, and the two others, according to the position of the boom, experience only a vertical pressure or operate as a counterweight for the load. The crane has been since October 27, 1897, in uninterrupted use, and has given the most complete satisfaction to its owner.

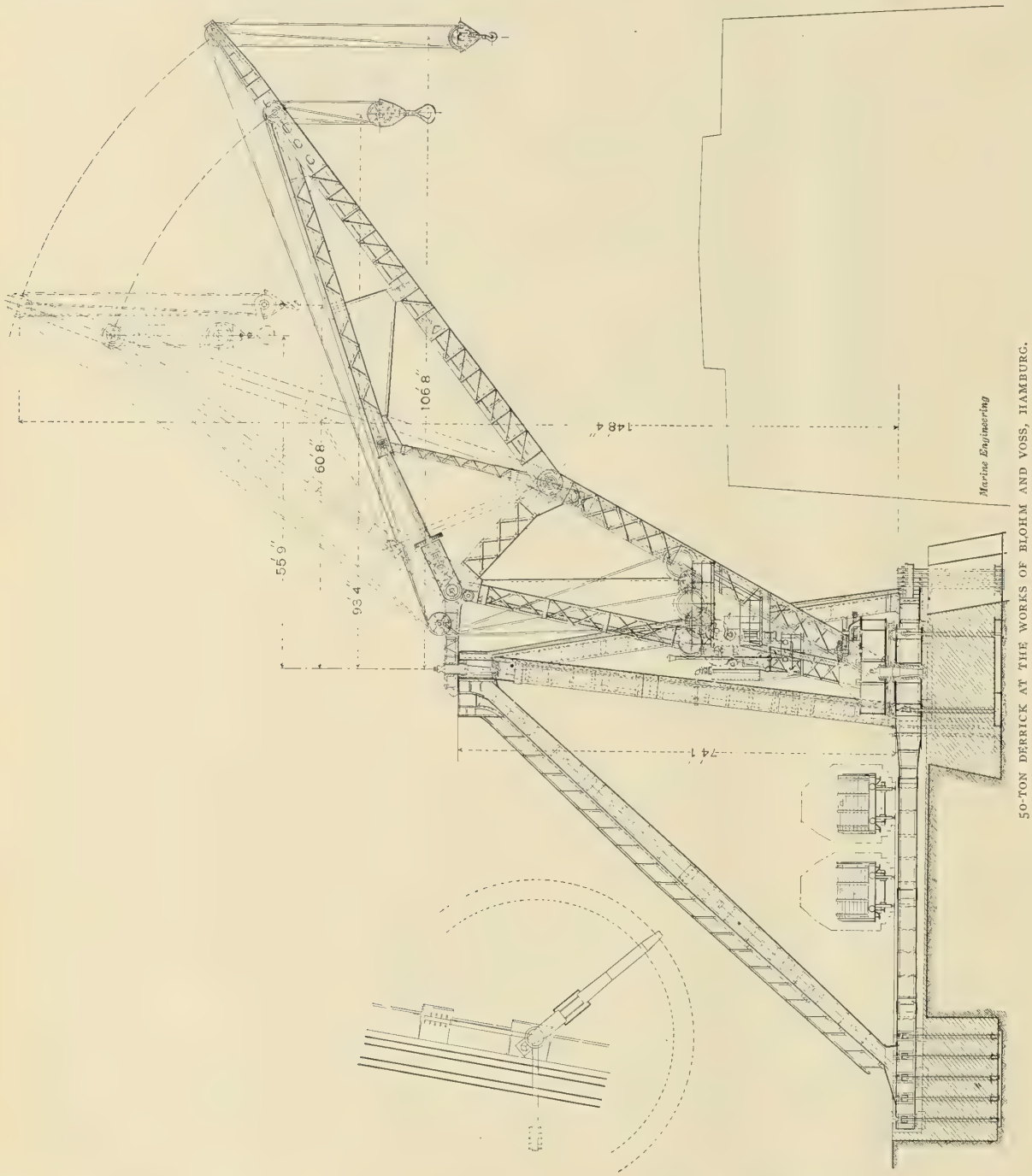
An entirely new and peculiar construction is found in a crane erected at the Kaiser Dock in Bremerhaven by the Benrather Company. This crane is of 150 tons capacity and seems to avoid the difficulties met with in previous types in a most efficient manner. The crane consists essentially of a stationary tower built of structural steel, within which a crane pillar is carried, with bearings at the foundation and at the top of the tower. At the top this pillar is connected to two symmetrical booms of girder construction. Upon one of these the operating trolley moves back and forth, while upon the other a balance weight is fitted in such manner as to insure stability whether the hoist has its full load or hangs free. As the crane pillar turns through 360 degrees, while at the same time the trolley may be operated in and out, the entire annular area between two radii of 72 feet outer and 26 feet inner radius may in this manner be readily served by the crane. Furthermore, as the crane is securely balanced, and especially against wind pressure, and the trolley moves only in a horizontal direction, it follows that the operation of the crane requires the minimum expense of work. The

*Translated and abstracted for MARINE ENGINEERING from the *Jahrbuch dee Schiffbautechnischen Gesellschaft*, 1901.

hoisting gear consists of suitable sheaves through which is rove a wire cable of about 2.4 inches diameter. The blocks are provided with seven sheaves, thus giving a sufficient number of sections of the rope to insure a large margin of safety.

The operation of the crane is brought about by means of direct-current motors under control from an operating house suitably situated. For hoisting the weight two motors are provided, aggregating 40 H. P. For turning the crane, as well as for operating the trolley, a single motor of 25 H. P. is employed. For holding the weight fast two self-operating mechanical brakes are provided, as well as an electrical brake which is put into operation automatically upon the stopping of the motors. Under varying conditions the hoisting speed may be varied as follows:

150	tons	load	2.25	ft. per mt.
75	"	"	4.25	" " "
37	"	"	10.	" " "
18	"	"	20.	" " "



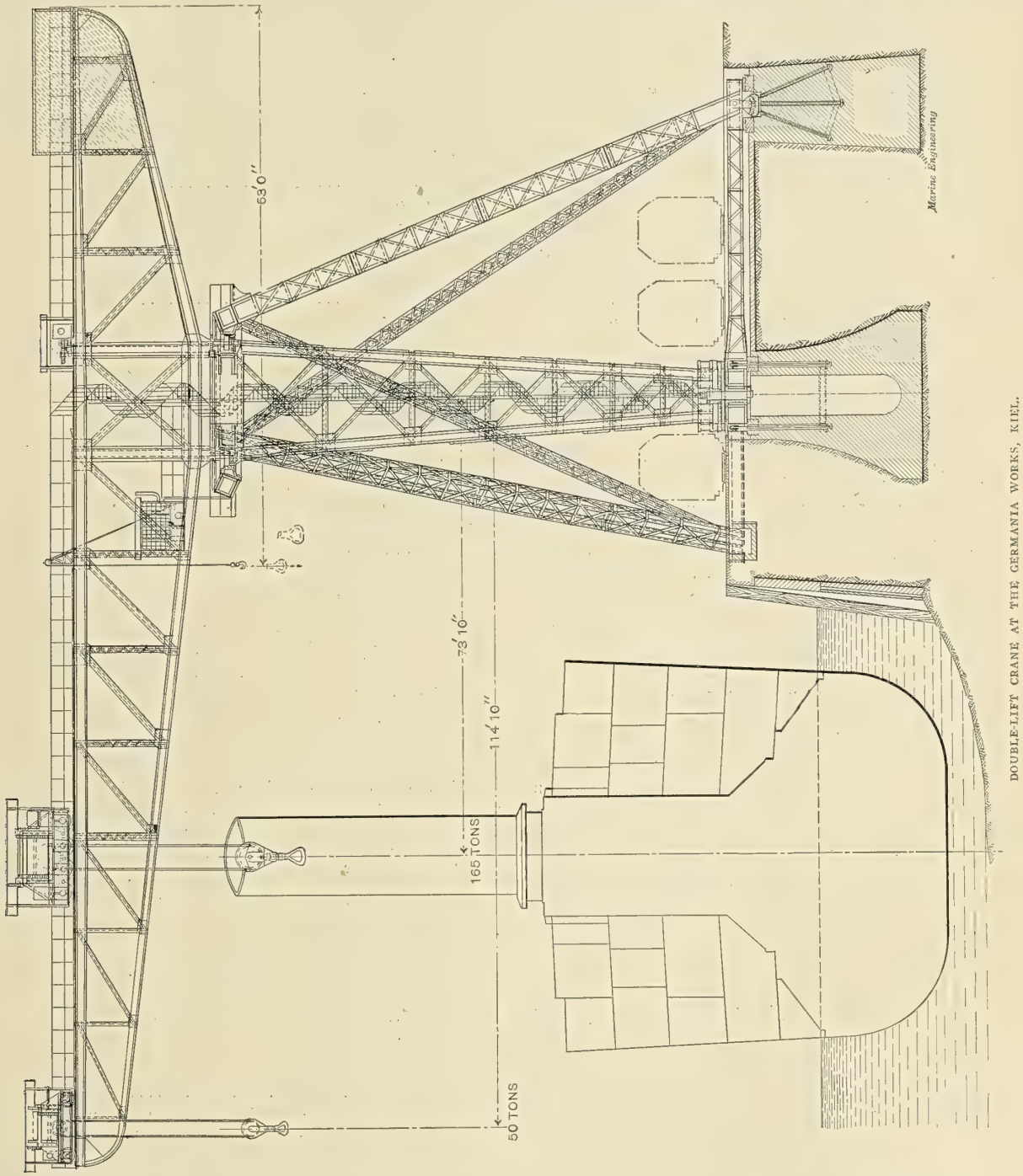
50-TON DERRICK AT THE WORKS OF BLOHM AND VOSS, HAMBURG.

The trolley may be operated at a speed of 25 feet per minute, while the entire crane in 7 minutes may be turned through one complete revolution.

The service of the crane is centered in the operating house, which is placed on the side of the boom. There are here mounted a double controller for hoisting and

turning and a single controller for the travel of the trolley. As the only objection against this crane it is to be noted that the boom must be placed at a sufficient height to clear the funnel and deck erections on the ship, while with masts in place its movement must necessarily be somewhat hindered.

The circle swung by the hoisting gear at its outer reach and with 45 tons load has a radius of 115 feet, while with a load of 150 tons the corresponding radius is 75 feet. The feet of the girder supports are carried on especially prepared foundations, one in the middle for the main support and three outer ones for the three



DOUBLE-LIFT CRANE AT THE GERMANIA WORKS, KIEL.

In accordance with the same general requirements the Duisburger Company has in construction for the Germania Company a crane shown on this page. The supporting construction is of girder form and is given a somewhat greater area of support, while the movement relative to the dock is somewhat less limited. supporting struts. The lower ends of these girder supports are tied together under the dock level, as well as to the middle foundation, with a connected construction, so that the outer three foundation blocks, of which two lie at the dock edge, only receive vertical pressure. The horizontal forces developed by the boom

are carried to the middle foundation block through a suitably arranged pivot.

The support of the vertical load on the middle foundation block is provided by a roller bearing. This contains 32 turned steel rolls 8 inches wide which run upon a track of forged steel. This track, with the rollers, is protected against dust and dampness by suitable oiling arrangements.

The support of the girder struts is united at the top by a ring of box form cross-section. On the inner side of this are the roller track and the axle of cast steel secured with steel bolts. The boom is supported against the rolling track on both sides by the help of four cast-steel rollers of 30 inches diameter and 8 inches breadth. These are arranged so as to give an adequate vertical support to the boom and so as to provide for adjustment in case of wear of either rollers or track. A pair of toothed wheels are connected to the driving axle from the turning gear, and the latter is operated by the motor on the upper side of the boom.

The support of the forces which are developed on the axle in turning is carried to the foundation through the girder support. To this end the members of the latter are provided with strong diagonal ties, so that both ties and struts are available for suitably carrying the forces developed.

In order to move the enormous weights and to provide for the possible wind pressure, the driving mechanism for turning the crane is made especially strong, so that no deterioration in any appreciable time is likely to be of importance. In order to assist in balancing the wind pressure with reference to a turning movement, the balance weight of the boom is given a corresponding surface exposed to the wind.

The boom itself consists of two continuous built-up girders, upon the dock end of which travel the two trolleys, while the other end serves to carry the balance weight. The arrangements in general are such as to provide a suitably broad track for the trolley, together with ample support for the load to be carried. In order to reach the boom from the ground a winding staircase is fitted in the main pillar. On the dock side of the boom the operating house is located where it may be easily reached by a covered passage from the top of the winding stair. This house is of sufficient size to contain conveniently all electrical apparatus, tools, a stove, and other necessary equipment. Furthermore, a small electric hoist is installed of about 1 ton capacity in order to serve for hoisting quickly small weights within this limit.

The two trolleys are entirely independent of each other, and each has its own connection with the operating motors. In order to securely hold the load in any position each hoisting mechanism is under control of a safety brake which may be operated either mechanically or electrically, so that any undesired movement of the load is efficiently prevented.

As the weight of the trolleys is considerable, an effort has been made to locate the hoisting gear as much as possible on the back arm of the boom. The hoisting ropes have a factor of safety of 8 to 10 and are carried over proportionately large sheaves. The hooks are mounted so as to turn on ball bearings in any direction which their use may require. For all turning parts, where possible, automatic oiling arrangements are provided. The electrical drive of the entire hoisting gear is arranged by direct-coupled motors, with provision for reversing, for movement in either direction. The various speeds of operation are as follows:

HOISTING SPEED, LARGE GEAR.

Maximum load, 140 tons	4	ft. per mt.
Load 100 tons	5	" "
Load 50 tons	6.5	" "
Clear	13	" "

HOISTING SPEED, SMALL GEAR.

Maximum load, 45 tons	13	ft. per mt.
Load 30 tons	16	" "
Load 15 tons	21	" "
Clear	43	" "

SPEED OF LARGE TROLLEY.

Load of 150 tons	16	ft. per mt.
" 100 "	20	" "
" 50 "	25	" "
Clear	33	" "

SPEED OF SMALL TROLLEY.

Load of 45 tons	50	ft. per mt.
" 30 "	60	" "
" 15 "	22	" "
Clear	100	" "

TURNING SPEED.

Crane fully loaded, measured at the hoist in its farthest reach	100	ft. per mt.
Crane without load, measured at the hoist in its farthest reach	115	ft. per mt.

The electric motors have the following capacities:

Hoisting motor for large trolley	50 H. P.
" " " small "	50 "
Traveling motor for large trolley	12 H. P.
" " " small "	12 "
Motor for turning boom	50 "

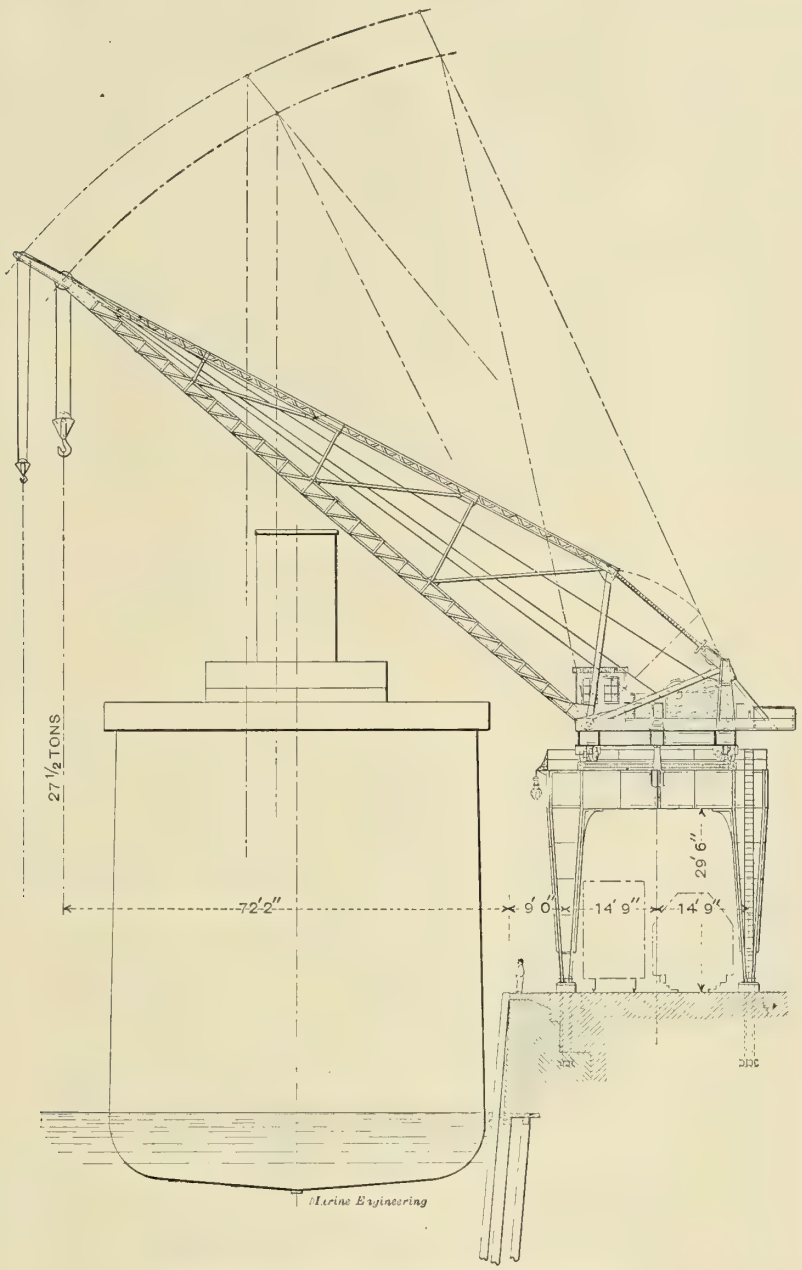
In the case of a similar crane built by the Benrather Company for the Vulcan yard, the capacity was fixed at 100 tons at a reach of 56 feet, or 45.5 tons at a reach of 84 feet. In this crane the girder pillar forms one continuous construction with the horizontal girder boom, and the entire apparatus rests and turns on its own base. The load is thus carried upon 12 trucks, each with 4 wheels. Four of these trucks are driven each by a 12-H. P. electric motor. The centering of the crane is secured through a steel king post in the center of the foundation. The trolley is arranged in the usual manner and is operated by a motor of 12 H. P. The main hoisting gear is provided with two motors, each of 26 H. P. The speeds of operation are as follows:

Hoisting 100 tons	4	ft. per mt.
" 50 "	8	" "
Speed of trolley	26	" "

Turning the crane through 360 degrees..10 minutes.

In addition to these cranes for handling the heaviest weights, there has come into use a further special type of smaller size and with a capacity of 3 to 5 tons. The especial purpose of such cranes is to serve for handling and placing on board the manifold lighter parts of the construction and equipment. Such cranes may also be used for unloading such parts of the material as come to the yard by water transport. They are constructed as traveling and turning cranes with vari-

able reach and great height of hoist. To insure the necessary stability these cranes operate on a track of at least 6.5 feet width. Thus the capacity of such cranes by a widened track may be increased up to 25 tons. In the crane of this character shown in the figure the reach, in the manner indicated, may be varied through a wide range. Such cranes are usually operated by a steam engine provided with steam from a boiler carried the usual style of the shear crane or shear legs, and operated by steam power. The engines for hoisting may also be used for propelling the pontoon by means of two screw propellers connected or disconnected by suitable clutches. In addition the shaft may be provided with a number of warping drums, by means of which the pontoon may be moved about in narrow waterways.



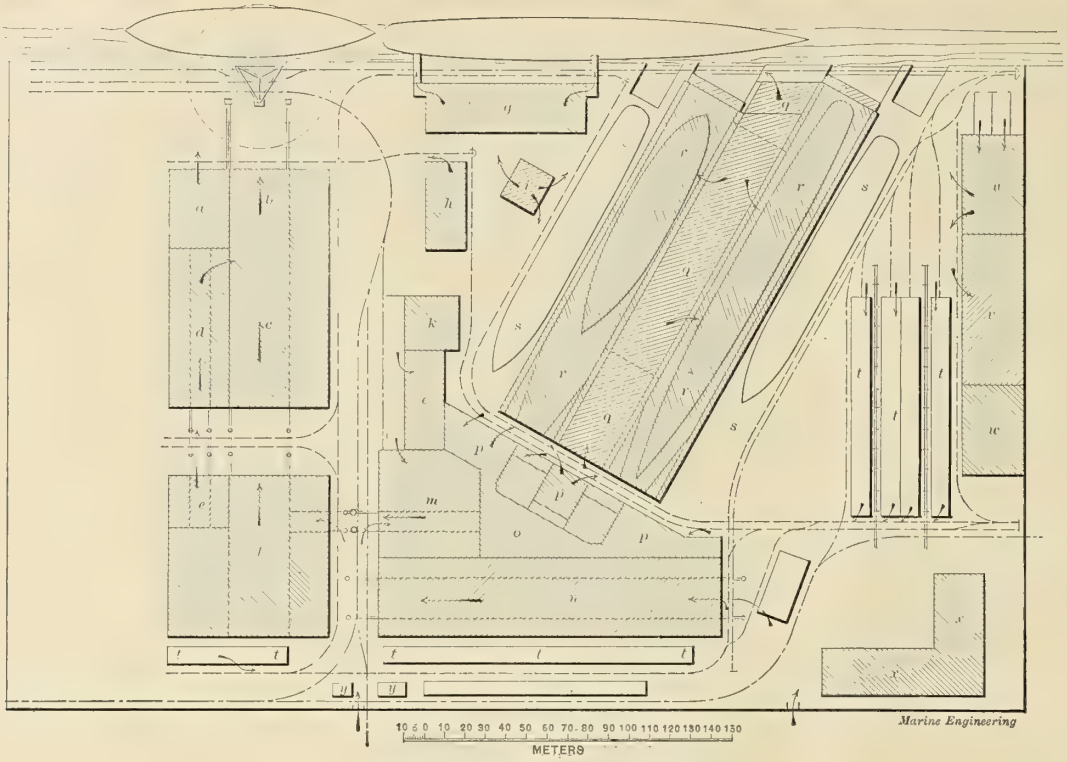
SHEAR-LEG CRANE AT THE WORKS OF BLOHM AND VOSS.

on the crane, and often serving in part as a counterbalance weight.

In connection with the same general line of operation, floating derricks or cranes play an important part, especially in connection with warship construction. They are of especial use in connection with handling heavy armor, guns, anchors, boats, etc. They are built after

The further arrangement for the transport of material about the shipyard, such as locomotive cranes, traveling gantries for the distribution of material at the stock racks, etc., can only be here briefly refered to.

An electric traveling derrick crane has been designed and built by the Benrather Company for general locomotive purposes, and may also be used for moving and



PROPOSED ARRANGEMENT OF A SHIPYARD.

	Area.	Ground Floor.	First Story.	Second Story.
a	12900	Coppersmith Shop.		
b	64600	Erecting Shop.	1-3 Machine Shop.	
c		Machine Shop.		
d	25800	Brass Working Shop.	Brass Working Shop.	
e	8400	Brass Foundry.		
f	60800	Foundry.		
g	21500	Wood Working Machinery and Fitting Shop.	Carpenter Shop.	Carpenter Shop.
h	9500	Store House.	Store House.	Store House.
i	5400	Paint Shop.	Paint Shop.	
k	7800	Power House for Electricity, Hydraulic Power, and Compressed Air.		
l	10700	Boiler House.		
m	27000	Forge Shop.		
n	73200	Boiler Shop.		
o	11300	Ship Forge Shop.		
p	30000	Shop for Working Structural Material Hot.		
q	56500	Shop for Working Structural Material Cold.	Assembling Decks, etc.	Mold Loft Floor.
r	148500	Two Building Docks.		
s		Two Building Slips.		
t	7000	Stock Yard.		
u	16100	Sawmill.		
v	24200	Lumber Yard.		
w	14500	Model Working Shop.	Model Working Shop.	Model Store House.
x	31000	Office.	Office.	Drawing Room.
y	1800	Gateway and Weighing Scales.		

switching railway cars. Each movement of the crane is carried out through a special motor and with the following speeds:

Hoisting ..... 50 ft. per mt.
Turning..... 4 complete turns per mt.
Traveling .....210 ft. per mt.

The motors provided are as follows:

Hoisting .....26 H. P.
Turning ..... 7 "
Traveling ..... 7 "

One point of advantage in this crane consists in the fact that only the crane pillar with the boom turns, while the entire lower structure remains fixed.

And thus I am brought to the conclusion of my considerations, to the development of a design for a shipyard in which there shall be represented, as far as possible, the various methods of transportation and handling previously referred to. The central point of this plant should consist of the two building docks, with two neighboring building slips as shown on the diagram. The two docks should be covered by a single building, while each building slip should be provided with a traveling crane. A peculiar feature may be noted in the location of the cold metal-working shop between the two building docks and covered with a continuation of the same roof which covers the building docks. On the ground floor of this shop, at one end, are located the various tools, punches, shears, etc., while in the middle is a sufficient place for the assembling of armored decks or for the construction of masts, bridges, etc. In the first story is found room for the assembling of decks and like structures. Tools of the lighter class are also located at the side or on the pillars of the building-dock structure. In the second story the mold loft is located, well lighted by windows in the roof. Light is also provided for the lower floors through suitable light shafts. The material, which in the lower floors is transported by the ordinary type of trolley, may be taken direct to the building dock by the aid of the traveling cranes or by use of the tracks at the head of the docks, and the same may be carried to the stationary crane at the fitting-out basin for installation in the ship.

At the head of the building docks are located the various forges, with bending slab and heating furnaces, while joined to the same on one side is found the boiler shop and on the other the central power station. The directions in which the work is carried out in the various shops are indicated on the diagram by arrow heads. On the left side of the yard, and directly in a line back of the large stationary dock crane and beginning from the land side, is located the foundry for iron and brass castings. These are in direct connection with the machine shop by means of tracks, so that the foundry crane may run direct into the machine shop and transport the various castings to the suitable machines without rehandling. On the other side these tracks extend to the water's edge at the stationary crane, so that the various pieces of the machinery, after erection in the shops, may be taken direct to the crane for installation in the ship. The brass foundry is also directly connected by a small traveling crane with the brass shop, next to which, on the water side, the coppersmith's shop is located. At the water's edge is located the carpenter shop, on the ground floor of which are installed the various woodworking tools, and from the second story of which two small crane runways lead to the water's edge. The fittings may thus be taken directly on board ship, and these runways are also made to serve as passageways to the ship by means of a suitable stairway at each end of the carpenter shop. A small traveling crane of 3 to 5 tons capacity, of the Blohm and Voss type, operates between the carpenter shop and the edge of the dock. In order that this crane may pass through the lower construction of the large stationary crane, as well as under the gangways leading from the carpenter shop, the boom may be suitably lowered. In the wake of the building docks and building slips this crane travels over bridges which, on the occasion of a launch or exit of a ship from the dock, may be lifted out of the way by a floating crane. This crane may also be utilized for unloading vessels at the water front and for bringing timber to the carpenter shop. The principal place for stacking material is served by a traveling crane, while for the other secondary locations small electric traveling cranes are sufficient. The arrangement of tracks is shown on the diagram, the dot-dash indication showing the arrangement of standard-gage tracks, while the lines made up of dashes show the arrangement of narrow-gage tracks. The open space on the left of the plan is reserved for a dry-dock. Should it seem preferable to build a floating dock a location for the same may be found in a canal lying at 45 degrees to the dock edge, in such manner that access may be obtained through the space lying between the foundry and machine shop. The office buildings include all business and technical bureaus, drawing rooms, etc. From the left wing of the same the stock piles are under ready observation, so that note may be taken of the condition as regards material of the various sorts. The entire plan is arranged to cover a minimum area, not alone to reduce the distance of transporting material, but also the better to provide for efficient oversight and administration.

And thus I will close this study with the hope that it may furnish many suggestions for the future; that, moreover, the shipbuilding industry in Germany may be stimulated through the brilliant developments of the last few years to still further widen its influence, to found new dock yards, to strengthen its hold on the markets of the world, and to enter into live competition with the yards of our foreign competitors.

Steamer Korea.—The Pacific Mail steamship *Korea*, which was described in Marine Engineering for June, 1902, has arrived at San Francisco and will be placed in the China service.

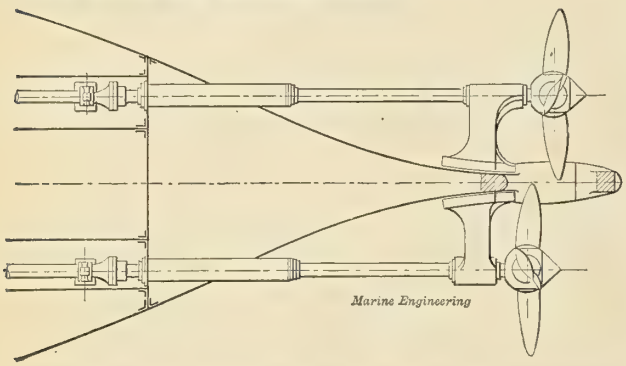
Year's Shipbuilding in the United States.—During the fiscal year ended June 30, 1902, the Bureau of Navigation reports that 1,657 vessels of 473,981 gross tons were built in the United States and officially numbered, compared with 1,709 vessels of 489,616 tons for the previous fiscal year. The decrease compared with last year is in sail vessels and canalboats, barges, etc. This year's new sail tonnage is 101,072 tons; last year's, 128,099 tons. New steel steamers aggregate 275,479 tons compared with 235,265 tons last year.

Reconstruction of Turkish Battleship Messoudyeh.

BY DAGNINO ATTILIO.

The Turkish battleship *Messoudyeh* has just undergone an extensive reconstruction at the yard of Messrs. Ansaldo, of Genoa. In 1890 a sister ship, the *Mendouhiye,* was remodeled and new propelling machinery fitted, but the single screw was retained. However, with the first-named ship the Turkish Government decided to convert her into a twin-screw ship, and the work has been carried out in a very substantial way.

In a vessel not intended for twin screws the attachment of the stern brackets to a stern not especially strengthened and constructed to receive them is likely to be a source of weakness. Referring to the accompanying drawing, we see that on the *Messoudyeh* advantage has been taken of the existing propeller opening to bring the two screws close together and thus reduce the leverage as much as possible. The feet of the stern brackets are extra broad for attaching to the hull. The weight of brackets and shafting is well supported by a flange with a T-shaped bar at the bottom of the frame, and the structure secured was so rigid that it was decided unnecessary to close in the shaft with plating and spectacle frames.



ARRANGEMENT OF TWIN SCREWS AND BRACKETS ON MESSOUDYEH.

The inner and outer bottoms were found to be in excellent condition, and, as the ship was well built throughout, she is considered to be good for many years of service.

The new propelling machinery consists of two sets of triple-expansion, four-cylinder, inverted engines of 11,000 H. P. Steam is supplied by 16 water-tube boilers of the Niclausse type, arranged in four groups of four boilers each. Both engines and boilers were constructed by Messrs. Gio. Ansaldo and Company, in the shops at Sampierdarena, near Genoa.

On the trial trip of the *Messoudyeh,* which was recently held, an average of 16 1-2 miles was maintained for six hours. Steam pressure was 300 pounds at the boilers and 250 pounds in the high-pressure valve chest. The feeding apparatus worked very well throughout, giving little trouble, and no accident happened to the engines or machinery. The main engines reached a maximum of 108 revolutions, driving the ship at 17 1-2 miles. As the contract required only 15 miles an hour, the results attained were satisfactory. The new machinery and fittings represent the highest type of marine work. The armament consists of Vickers breech-loading rifles.

INTERIOR DECORATIONS OF THE HELENITA.

The decorations of the saloons and state rooms on the steam yacht *Helenita* are as handsome as anything of the kind seen afloat. A general description of this yacht was given in Marine Engineering for July, but the accompanying views were taken recently, and show the yacht as she is at present. The interior work was designed and executed throughout by the Pottier and Stymus Company, New York city.

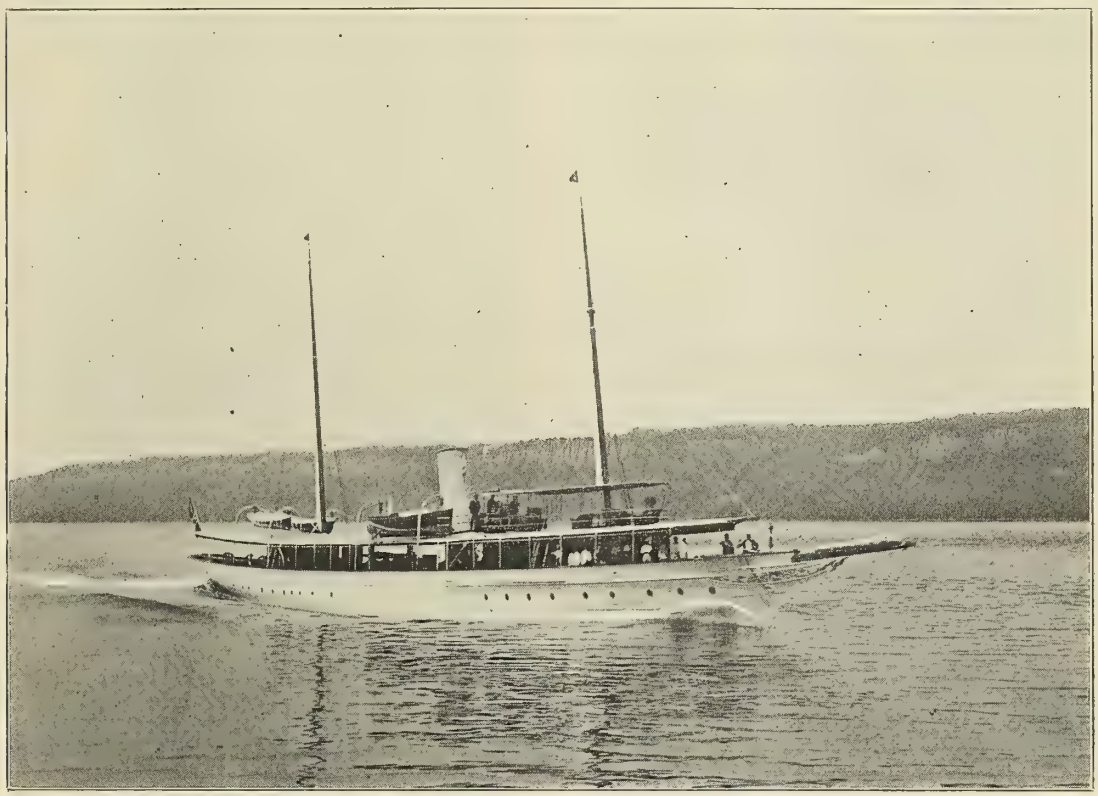
The forward deck house contains the dining room and smoking room; the former, taking in the entire forward part of the house, is of English oak with backgrounds of carving carved out of the solid, and the ground of same is picked out in red. Over the sideboard is a painting on the wood panel of a marine view, which is stained into the wood and shows the grain throughout. The ceiling round the mast is handsomely decorated with carving, and, with the mast as a center feature, there is an English oak extension dining room table with the extension end forward of the mast. The chairs are of English oak and the backs are carved with prows of ships. The hangings are of green velour and the floor is covered with a green Wilton carpet. The general design of this room has been executed in the Norwegian style.

The smoking room is entered either by a passage from the dining room or from the deck on the opposite side. The decorations are of the Dutch style, with side wainscoting, and treated the same as the dining room. Over the settee is a wood painting, also executed similarly to that in the dining room. The settee is of red leather and the curtains are of red reps.

The main salon, or music room, is in the after deck house. It is executed in mahogany with panels of crotch veneer; the woodwork is inlaid marquetry and the general style of decorations is modern English; the ceiling beams are supported by cupid brackets made of special design; the curtains and upholstery are of blue. A very handsome clock, with dolphins carved in the case, ornaments the mast. The piano, secretary's desk, the library and other furniture have been made to harmonize with the design. A staircase leads to the lower hall, the caps of the columns, or newel posts, being ornamented with carved mermaids carved out of satinwood, and the balustrade with carved dolphins between the rails. The curtains and coverings are of printed velvet.

At the foot of the stairs, and at the after end of the ship, is a double state room extending from side to side of the boat. A large bedstead is built at either side, with cushioned seats below. The panels at the side of the beds and the cushions are of printed velvet, and the decorations forming the center feature of the headboards of the bedsteads are carved dolphins. This room is finished in satinwood. Another guest's room is finished in birch in the modern English style, treated simply throughout with large plain panels of selected veneer. The headboard of the bed is painted with two allegorical figures on wood, representing travel and pleasure. The decoration on the bureau and side of the bed is on the same style as that of the room. The ceiling is decorated with simple bands of colors between beams, and the side walls with fine diaper pattern in tones of green and purple.

Another state room is furnished in bird's-eye maple with the ornament applied in birch moldings, forming raised panels. The doors and panels are of specially selected maple veneer, and the ceiling is laid in small ornamental bands in blue, forming panels. The side walls are decorated an all-over-pattern of blue on a cream ground, and the curtains are also of blue. A simple but very effective decoration is that of the white and gilt room in the Louis XVI. style. The entire room is in ivory white. The coverings and curtains are of pink and green stripes with chintz coloring and carpet selected to match.



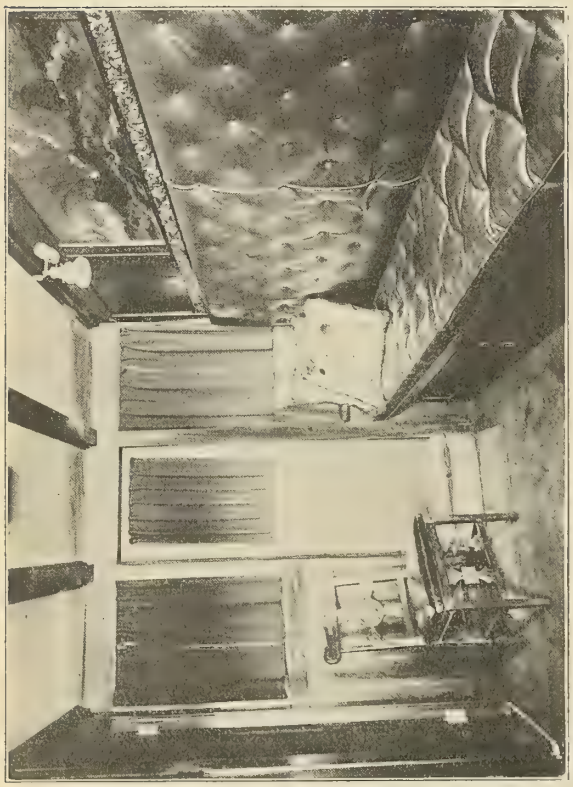
STEAM YACHT HELENITA, BUILT BY THE GAS ENGINE AND POWER COMPANY AND CHARLES L. SEABURY AND COMPANY CONSOLIDATED.

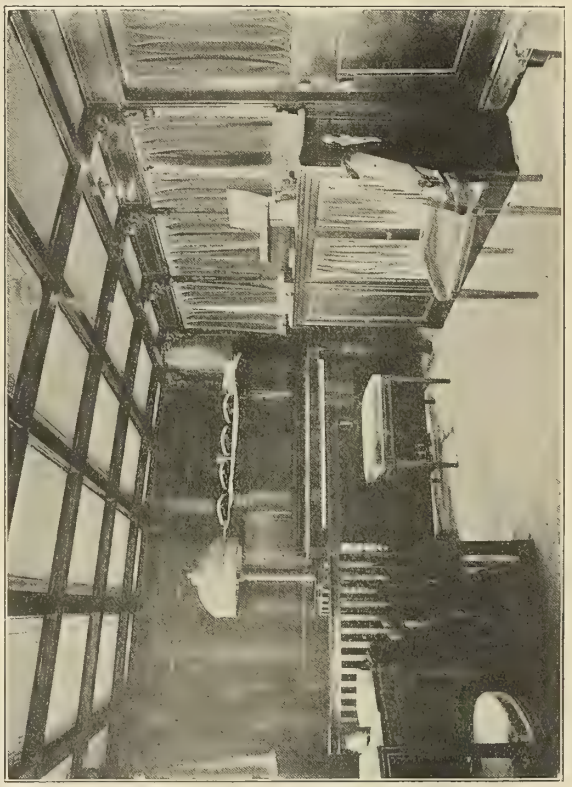
At the forward end of the passage leading from the lower salon is the owner's state room, which, naturally, is the handsomest of all. The wood used is satinwood inlaid with marquetry of white holly and ebony, and only the best selected woods have been used. Provision has been made for dividing this state room into two rooms by a portable fore and aft center line bulkhead, the material for which has already been cut out and can be easily erected. Large oval mirrors with gilt frames form the center feature of the large panels. There are settees at either side, covered with gray silk grounds with figures of gray, green, and purple, and the curtains and cushions are of the same material. Under each settee are chests of drawers, and the chiffonier and dressing table are the same designs as the room. The ceiling is decorated with a pearl-gray ground with an ornament of soft emerald and salmon, pink, and green. The general design of the room has been executed in the English Renaissance style. The hardware and electric features are of a greenish-gray gold, especially handsome. Forward of this state room are a bath and toilet rooms, and other bath rooms are provided *en suite* for the guests' rooms. All these bath rooms are decorated in white enamel and have cork tile floorings, and in each is placed a wardrobe.

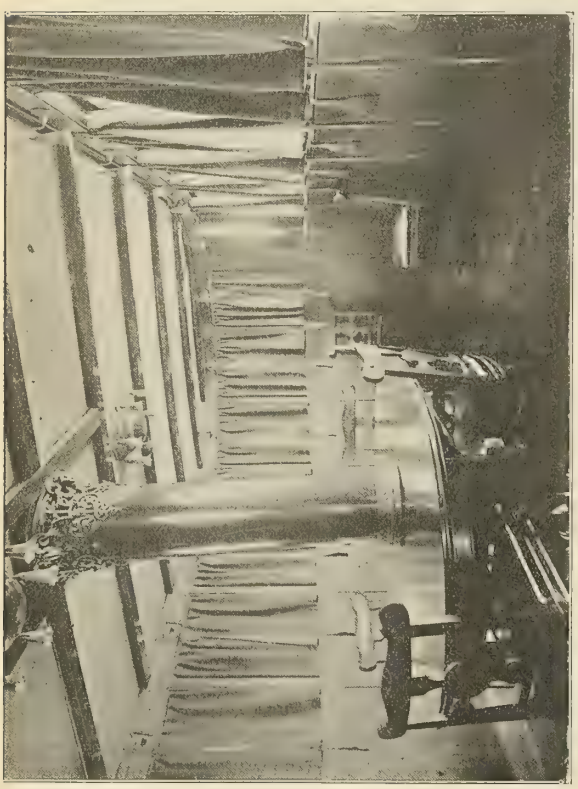
The general dimensions of this yacht are: Length over all, 185 feet; length on water line, 150 feet; beam, molded, 22 feet; depth, molded, 12 feet; draft, 9 feet. With these limiting dimensions, the designers have made the best use of the space to the advantage of the owner, Mr. Frank J. Gould.

United States Steel Corporation Earnings.—The net earnings of the United States Steel Corporation for the quarter ending June 30 were $37,691,696, an increase of $11,329,696 over the same period last year. Quarterly dividends of 1 3-4 per cent. on the preferred stock and 1 1-2 per cent. on the common stock were declared.

Roach's Shipyard.—The entire $1,000,000 stock of Roach's Shipyard has been taken over by the Delaware River Ship and Engine Building Company, incorporated under the laws of New Jersey, with $5,000,000 capital; $2,500,000 5 per cent. bonds will be issued. John B. Roach is president of the new company, and D. E. Ford, formerly of the Standard Oil Company, will be general manager; Edward L. Levy, formerly connected with Neafie and Levy, will be vice-president and treasurer; and Osborn Congelton will be vice-president. The company has now under contract two large coast steamers, one for the Savannah Line and the other for the Mallory Line.



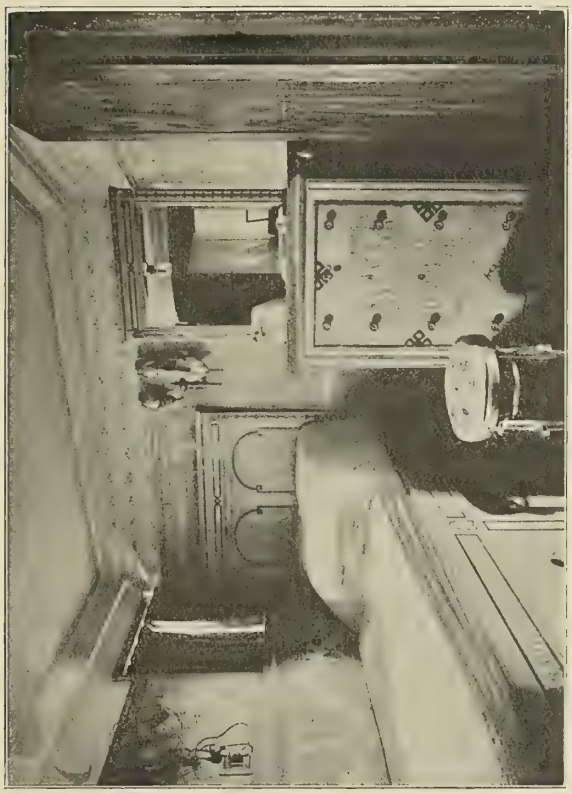


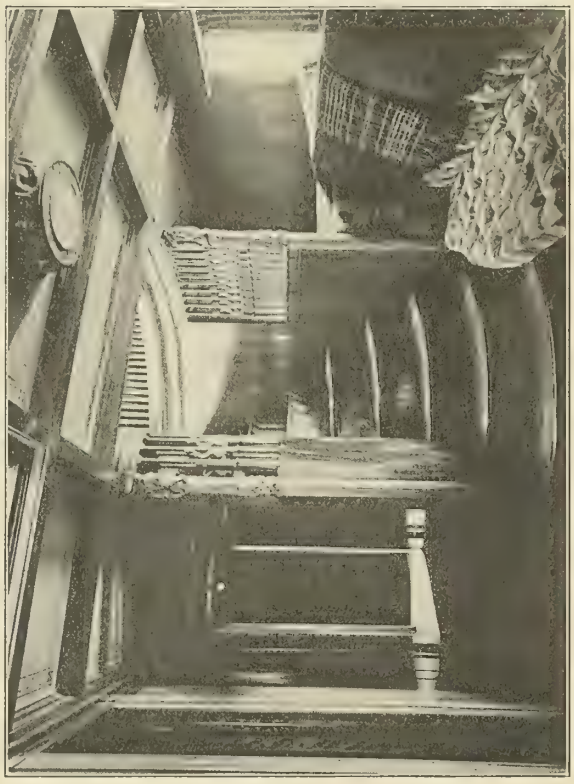


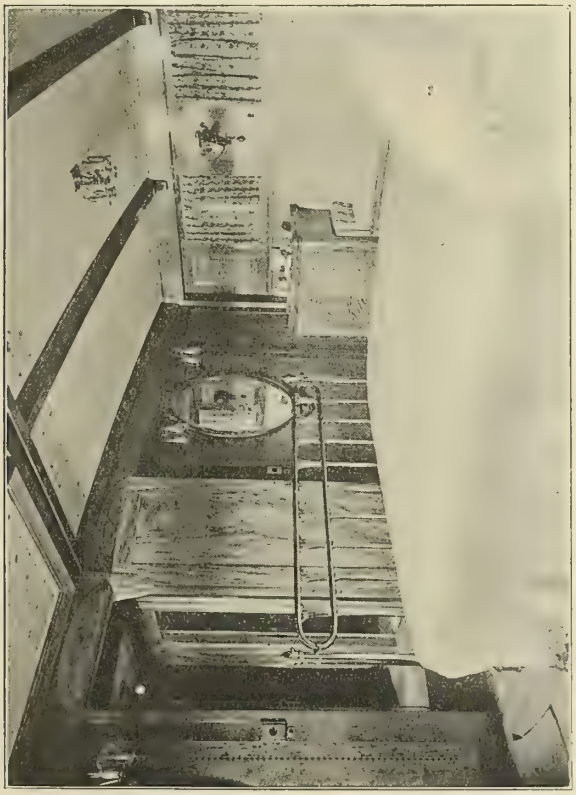
INTERIOR VIEWS OF DECK CABINS ON THE HELENITA.

Smoking Room.
Main Salon, Looking Aft.

Dining Room, Looking Forward.
Main Salon, Looking Forward.







VIEWS BELOW DECK ON THE STEAM YACHT HELENITA.

Guest's Room, Bird's-eye Maple.
Lower Cabin and Stairway.

Owner's State Room, Finished in Satinwood.
Guest's Room, in Gold and White.

Marine Engineering

Published Monthly by

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Notice to Advertisers.

Changes to be made in copy, or in orders for advertisements, must be in our hands not later than the 15th of the month, to insure the carrying out of such instructions in the issue of the month following.

WE have before in these columns referred to the gasoline engine and other motors of the same general type, chiefly with reference to their use for pleasure purposes. The gasoline engine, as representing the type of such motors, merits, however, a word of notice with regard to its uses for more purely economic purposes. It has already found its way into boats of small size used for a variety of useful purposes, and with an increase in the sizes in which it can be made practicable there is every reason to expect an increase in the uses of this character. It is perhaps fair to say that with engines of this type it has not thus far been found practicable to carry the power developed in a single cylinder much beyond 20 or 25 horse power. Cylinders can, of course, be multiplied in number to three or four, so that an engine of perhaps one hundred horse power is not beyond reach at the present time. The gasoline type of engine possesses well-known characteristics, which need not be here repeated in detail, and within this range of power it may fairly merit consideration for industrial and commercial uses as well as for pleasure.

For small short-run excursion steamers, light ferryboats, small shallow-draft screw steamers for all purposes, and for all craft fitted with auxiliary power, as fishing craft, oyster boats, etc.—for all of these the claims of the gasoline engine command reasonable and fair consideration.

There is one feature, however, which should not be overlooked, and which seems to render the gas engine relatively less suitable than the steam engine for purposes of the general towboat character. This results chiefly from the relatively irregular crank effort with such engines, and from the extent to which inertia is called upon to carry the engine through the non-working stroke or strokes. A distinction enters here between the so-called two and four-cycle types. In the former one stroke in two or one per revolution furnishes power. In the latter, one stroke in four or one in two revolutions gives power. It might be expected that in this respect the two-cycle type would possess marked advantages over the four. This expectation is, however, scarcely realized, and with a little higher speed of revolution in the four-cycle type there seems to be no marked difference in this respect.

It might also be expected, with one power stroke in four in one case and one in two in the other, that there would be considerable advantage with the latter regarding the weight required for a given power to be developed. With the somewhat higher revolutions referred to, however, and the attendant modifications in structure, the difference in this respect seems to be but slight and in any event not sufficient to furnish a determining feature between the two systems. The chief actual point of difference between the two types, four-cycle or two-cycle, seems to be in the difference in their efficiencies as heat engines. Careful tests involving a measure of the power delivered and the gasoline consumed show a marked difference in favor of the four-cycle type, which is only what might be expected when the features of the two types are compared. Thus far the four-cycle type has attracted but small attention for marine purposes. In spite of a somewhat greater apparent complexity, however, it seems to possess greater certainty of action and superior efficiency. The latter consideration, especially, is one which will have weight in connection with commercial uses, and we believe that there is a fair field for further effort looking toward the better adaptation of gasoline engines in general, and especially those of the four-cycle type, to marine uses of a commercial and industrial nature.

WE would call attention to the conclusion, on another page, of the article continued from last month relating to shipway and dock handling appliances, especially as represented by the leading practice in the large German yards. This article, translated from the annual volume of proceedings of the young but vigorous German Society of Naval Architects and Marine Engineers, gives without doubt the most extended and detailed discussion of this important topic which has yet been published. We have been inclined, in this country, to consider that we are far in the lead of the world in methods for handling grain, coal, ore, structural material, etc., and in general there is undoubtedly reason to admire the energy and skill which American engineers have displayed in this field. We should not forget, however, that foreign engineers are also at work on these same problems, that they are well acquainted with the methods most in vogue in this country, and that in their own way they are finding solutions worthy of our careful attention. In particular is this true in the field of marine construction, and the display of designs and actual construction in the original article, only a part of which could be reproduced, shows how much attention German engineers are giving to the problem of handling and distribution in connection with marine work.

We are not likely, in fact, to exaggerate the importance of this matter in connection with carrying on engineering work on a large scale. An efficient and adequate system of handling saves time by accomplishing this part of the work far more quickly than it could be done by hand; it saves expense by substituting mechanical energy for the human energy of an army of men, and it saves time and promotes efficiency, both in the shops and at the ship, by doing the work of handling and distribution with far greater certainty and efficiency than could be done by any army of men, no matter how numerous or how well trained. The need of an efficient system for carrying on this part of the work is now considered as important and as necessary a part of the equipment of a shipyard as the tools for preparing the material, or as the shipway itself. We would commend the article by Herr Schwarz to the study of all who are interested in this problem, and can assure them that they are likely to find much therein which will be helpful and suggestive in their consideration of the many questions involved.

SHIPBUILDING on the lakes is looking forward to another year of prosperity. The general condition may be best indicated by the fact that at the present time some twenty vessels are under contract in the yards of the American Shipbuilding Company, with several more in the yards not under the control of the combination. In looking over the dimensions of these vessels, it is interesting to note the small number of classes into which they fall. Ten of them are of "canal size"—that is, of suitable dimensions to pass through the locks on the Canadian canals and thus permit of passage to the Atlantic coast. These vessels are, therefore, 241 feet long on the keel by 41 feet beam and 18 feet depth. The other ships under contract are mostly in the class of large freighters and fall into two classes—one 380 feet long by 50 feet beam by 28 feet depth, and the other 414 feet long by 50 feet beam by 28 feet depth. It is of interest to note to what an extent lake shipping tends to standardize itself into classes. Aside from passenger steamers, there are three well-marked types or classes of cargo steamers—the small steamer, 200 to 220 feet long by about 40 feet beam and 16 feet depth; the large steamer, about 400 feet long, 50 feet beam, and 28 feet depth; and the canal size, as noted above. Sizes and dimensions of engines and boilers also tend to fall into the same standard classes. The steam pressure, as a rule, is 170 pounds, and the engines are all three-cylinder, triple-expansion. Natural and assisted draft are both used, in the latter case both the Howden and Ellis and Eaves systems being employed.

The lake ship operator and ship builder both have peculiar problems to meet in connection with the local conditions of water and traffic, and between them it is certain that they have evolved a peculiarly efficient type of boat having in view the service required. These boats combine moderate draft, fair speed, good coal economy, unrivaled facilities for loading and unloading the cargoes they are intended to carry, and such a measure of strength, general safety, and convenience of life on board as the conditions of lake service are found to require.

If the conditions of commerce and industry in general and of shipbuilding in particular may be in any measure safely inferred from those of shipbuilding on the Great Lakes, the coming season bids fair to be one of continued activity and prosperity for all concerned.

MISHAPS AND REPAIRS.

Repair of a Feed Pump.

After two years of working, a feed pump of cast iron, similar to the sketches, 1, 2, 3, broke down as shown at *A*. At this place there was a weakened part, and the boss provided for the fitting of the return cock broke down. This pump was removed and another one furnished by the builder of the machine was put in its place. After about three years almost the same mishap took place. There was faulty design and faulty molding.

The following repair was finally decided upon:

1. The valve seat *D* was removed.

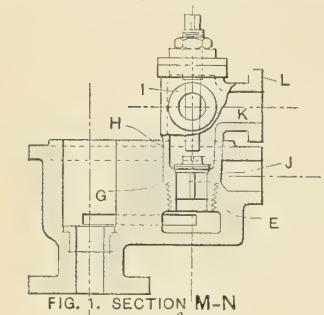


FIG. 1. SECTION M-N

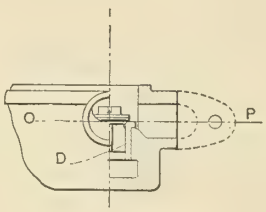


FIG. 3. SECTION R-S

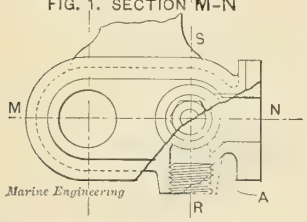


FIG. 2. PLAN AND SECTION O-P

2. The part *E* was threaded, the part *G* was dressed on a lathe, and the part *H* was bored at the same time.

3. A box, *I*, in brass was made, containing the valve seat at *J*, the boss *K* to receive the same return cock, and a strap or bridle, *L*, to receive the feed pipe.

4. This box was turned and fitted in place, making a tight joint at *G*.

5. The feed pipe was changed so as to be connected at the strap *L*. The same operation was made at the return pipe.

This repair was made seven years ago. We have visited it lately and it was in very good condition. The pump has been in continuous operation. J. M.

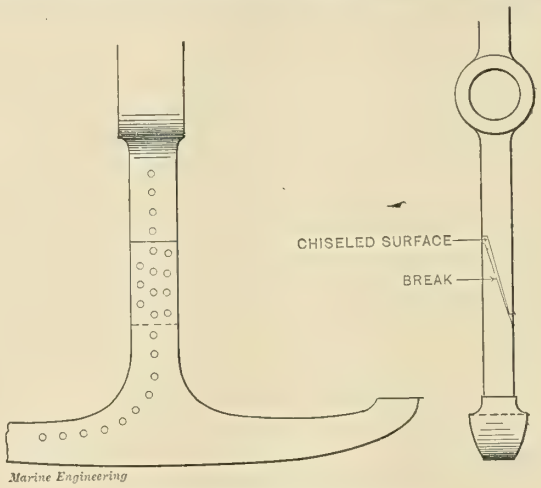
Broken Stern Frame.

The interesting account of repairs made to the stern frame of the tug *Tatoosh*, which appeared in the July number under *Mishaps and Repairs*, reminds the writer of repairs made to a forged stern frame on a towboat on the Atlantic coast some time ago.

We had docked the tug *N*—— for general overhauling to the bottom, and only then discovered a crack in the stern post below the propeller boss. Close examination showed that the frame was cracked entirely through, as shown in the cut, evidently along the line of the weld of the upper and lower parts.

The *N*—— had a balanced rudder supported from the deck, and the whole rested in a shoe at the stern frame. It was, therefore, necessary to have the lower end of the frame well braced to take the side thrust of the rudder. We could not wait for a new stern frame to be made, and, from the various plans suggested for repairing, I decided on the following:

The plates adjoining the lower part of the stern frame were removed, and the lower end piece taken up to the shop. With pneumatic tools a scarf was made along the fracture of the upper part of the frame, as shown by the dotted line in the illustration. A template was then made, and the lower end of the frame was built up under the forge hammer in the shop to conform to this surface. Holes were then drilled through the scarf of the lower piece, and the frame taken out and put in place. These holes were matched in the other part of the scarf and in the plating. The plates were then put back in place and all of them riveted up, the rivets in the way of the scarf being driven through both



METHOD OF REPAIRING STERN FRAME.

pieces of the frame and the side plating. By this means we avoided putting on tie plates over the crack, which would have necessitated driving the rivets through the stern frame and four thicknesses of plating.

The tug has been in constant service for over a year, and, upon docking a few weeks ago, examination of the fracture showed no indications of the rivets having started. H. D. F.

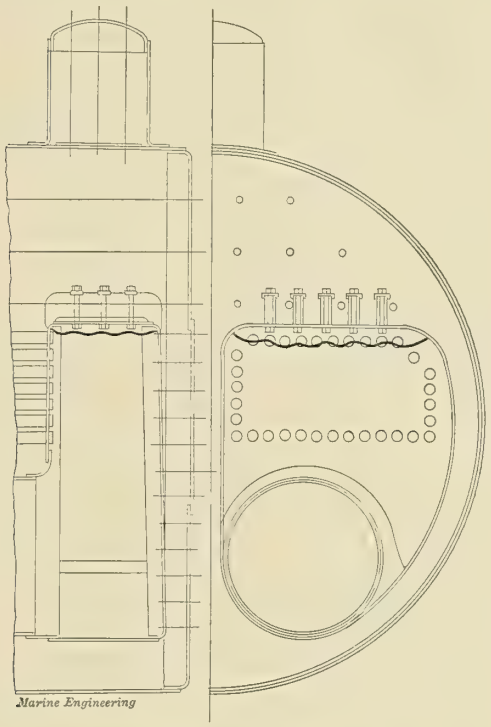
Collapse of Crown Plate of Main Boiler.

Editor Marine Engineering:

There has recently been up for examination before the British Board of Trade a case of boiler explosion which was the direct result of placing an incompetent man to fill the position of chief engineer on a small coasting steamer.

The accident has been brought to my close attention, and I have inspected the boiler myself. The vessel was employed in carrying coal under the English flag. Before leaving port the engineer emptied the boiler and took in fresh water while at the dock, filling the boiler to the height of about a foot above the top of the gage glass, in order to make the passage and discharge the cargo without pumping in any seawater. The donkey boiler was in bad shape, so the main boiler was used for discharging cargo as well as supplying steam for the propelling engines. On the passage priming occurred, as was to be expected, but neither during

the passage of ten hours nor while discharging cargo with two steam winches for about 8 1-2 hours was any water level visible in the glass. The glass was frequently blown through by opening the drain cock, but it was always found to be "full glass," and therefore no water was pumped into the boiler. On getting out to sea again, the high-pressure slide valve began to screech, and later on, while the fireman was removing a bag which had been tied around the main steam pipe and which had taken fire, and the engineer was again blowing through the gage glass, the furnace doors were blown open and the contents of the boiler were emptied into the stokehole, without, however, injuring the engineer or fireman, who managed to escape on deck. The vessel was disabled and had to be towed back to port. The drawing shows the condition of



COLLAPSE OF A CROWN PLATE.

the port combustion chamber crown, which had collapsed to the extent of about 7 inches. The crown of the starboard combustion chamber was severely distorted, but none of the stays gave way. The sides and tube plates of both chambers and the upper rows of tubes were so damaged that it was decided to fit a new boiler. At the time of the explosion the working pressure was about 70 pounds per square inch. On inspection, the valve on the steam space of the boiler communicating with the top of the water gage was found to be completely blocked with soft deposit, and consequently, when the gage glass was blown through by opening the drain cock only, the water was forced above the top mounting, giving the appearance of a full glass. Had the man in charge tested the water gage by what is known as the "double shut-off" method, he would at once have seen that the steam passage to the gage was obstructed. The chief engineer was not a trained mechanic and possessed no certificate, but had had many years' experience as an engine driver at sea, and was regarded as an exceptionally careful and steady man. J. M. H.

QUERIES AND ANSWERS.

Q.—If the high-pressure cylinder of a compound engine was disabled, would it be safe, after hanging up the high-pressure piston on the top center, and removing the high-pressure valve, to run the low-pressure without blocking the top steam port, or would it be better to drop the piston to the bottom and shore it down? If you know of any better way to fix the engine so that the ship could be brought to port, you would oblige by letting me know; also if it would be wise to try and dock the ship while working the low pressure only? F. S. S.

A.—We should prefer to drop the piston to the bottom of the stroke and shore it down, at the same time plugging or blocking off the steam ports leading to the cylinder, but more especially the one at the bottom. As to whether this would be more convenient than the first method you proposed, would depend on the circumstances of the case. If the high pressure connecting rod were disconnected there would be nothing in the way, and the piston with rod and crosshead might readily be dropped to its lowest position. If the connecting rod were not disconnected, however, and thus gave motion to the crosshead, it would be necessary to shore the piston in its topmost position, and in such case the top ports should be, of course, carefully blocked off.

If one cylinder is out of commission there is probably no better way to bring your ship into port than by disconnecting such cylinder and proceeding with the other. As to whether it would be wise to try and dock the ship while working the low pressure cylinder only, this would depend entirely on the special circumstances of the case. We have seen single crank engines which handled so readily that a ship could be docked without any special difficulty whatever. In such a case as you assume, however, with only one cylinder of a compound, it might be doubtful if the adjustment of the valve would be that best suited to the quick operation of the cylinder as a single engine. If there were any doubt on this point we should be inclined to employ the services of a tug for docking the ship.

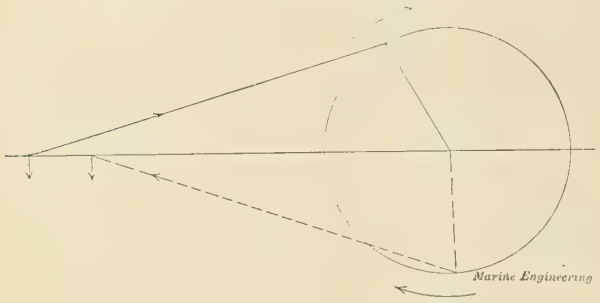
Q.—I have a feed pump; the ratio between steam piston and water piston surfaces is 2. Is the ratio between steam boiler pressure and water feed pressure in delivery pipe equal to 2, *whatever* being the feed water valve's opening? D. A.

A.—The answer is no. With the feed check well open the pressure in the feed pipe is only slightly above that in the boiler, except as momentary shocks may cause it to rise higher. The extra load on the piston due to its larger area is taken up by overcoming the friction of the moving parts of the pump, and the inertia of the water from rest in the barrel of the pump to motion through the feed pipe. As the feed check is closed down or as the feed pipe is longer and has more angles, bends and turns, or as the pipe becomes smaller for the amount of water flowing through it, more and more pressure will be required on the water side of the pump to force the water through the pipe into the boiler through the check valve. In such case it may require nearly the whole load on the steam end of the pump, and the pressure in the water cylinder may be nearly twice the full boiler pressure. Usually, however, the steam is throttled before entering the steam chest of a feed pump, so that it is rare that full boiler pressure is brought to bear on the steam end of the pump. In case it has full pressure, with feed check wide open and a good sized pipe with straight lead, the pump will be liable to run away; that is, slam and pound, the unnecessary pressure on the steam side being absorbed in producing this violent motion in the column of water in the feed pipe.

Q.—How would you determine on which guide the pressure acts in case of an inverted vertical engine driving a right handed propeller? A.

A.—In considering this question it must be remembered that the engine operates by reason of the pressure on the piston, and that in consequence the crank is pushed down on the down stroke and pulled up on the up stroke. Having this in mind and referring to the diagram it will be clear that on the down stroke,

due to the obliquity of the connecting rod, the reaction upon the crosshead will tend to *push* it over transversely, producing a lateral pressure on the guide *opposite* to the side on which the crank is then found. On the up stroke, on the contrary, the obliquity of the rod will tend to *pull* it over transversely, thus producing a lateral pressure against the guide on the *same* side. It results from this that the pressure on the guide is always on the same side so long as the engine is turning in any one direc-



tion. It is also clear that this side is that on which the crank is located on the up stroke. As a general rule, therefore, we have the following:

The guide which carries the load is on the side occupied by the crank during the up stroke or during the stroke toward the cylinder.

In the particular case which you mention the guide on the port side would therefore carry the load so long as the engine was turning ahead.

Q.—I would like to have the following question answered: M. J., a marine architect and ship carpenter, hires out by the day to design, superintend and build a steamboat for A. D. Co., the latter party finding all material. M. J. first makes a model and a set of patterns and then builds the boat. *Who has a right to the patterns?* Has A. D. Co. a right to use and dispose of these patterns without M. J.'s consent? M. J.'s experience and study of 30 years are embodied in these plans and patterns.

A.—This is a difficult question to answer without knowing further particulars of the contract entered into between the two parties. If M. J. is simply hired by the day to build and superintend the boat, all of his work belongs to A. D., as is the case with every machinist or workman who hires out. If, however, M. J. agrees to design and superintend the building of the boat, the designs are his own. This latter course is the one usually adopted by naval architects, but, from the information you give us, we believe that by the terms of the contract M. J. has no claim for any of the products of his work while hired by A. D. Co.

Q.—1. Are there any objections to a *steel* hull for a gasoline engine-driven boat?

2. Would there be more danger of explosion in the gasoline tanks on a very hot summer day in a steel hull than in a wooden hull, the boat being constantly practically without motion in the rays of the sun?

E. K.

A.—1. There appears to be no special reason why a gasoline engine should not be used in a boat with a steel hull.

2. It should be remembered that gasoline in itself is not subject to explosion. It is only when its vapor is mixed with a suitable quantity of air that such danger arises. It should be further remembered that gasoline vapor is heavier than air and that therefore after formation it will tend to settle to the lowest point attainable and there collect. To explode a mixture of gasoline vapor and air a relatively high local temperature is needed. For this reason a spark is commonly employed in gasoline engines. This also shows the danger of striking a match or of introducing a light of any kind, or possibly even a glowing bit of vegetable matter such as a lighted cigar, into any space which may possibly contain gasoline vapor and air. The greatest danger in a gasoline boat, therefore, is from a leak into an inclosed space where the gasoline may collect and vaporize, forming the explosive mixture referred to above.

Regarding danger from exposing a gasoline tank to the rays of the sun it may be said that the only danger which is apparent is that of developing, due to the heat, a sufficient pressure of gasoline vapor to possibly explode the tank. Such an explosion of course would not necessarily be accompanied by fire. It would mean simply the development of a vapor which might bulge and explode the containing tank. If fire were present an explosion of mixed air and vapor might follow as a secondary result. There does not, however, seem to be any possibility of the direct explosion of gasoline vapor in a tank exposed to the rays of the sun. In the first place the gasoline vapor alone is not explosive, and even if some air were present the temperature required would be far higher than anything likely to be reached under the circumstances which you mention.

Repairing the Steamship Etruria.

Extensive repairs were necessary to the steamship *Etruria* after that vessel reached port, following the accident whereby her rudder post, propeller, and the external portion of the propeller shaft were lost in mid-Atlantic some months ago.

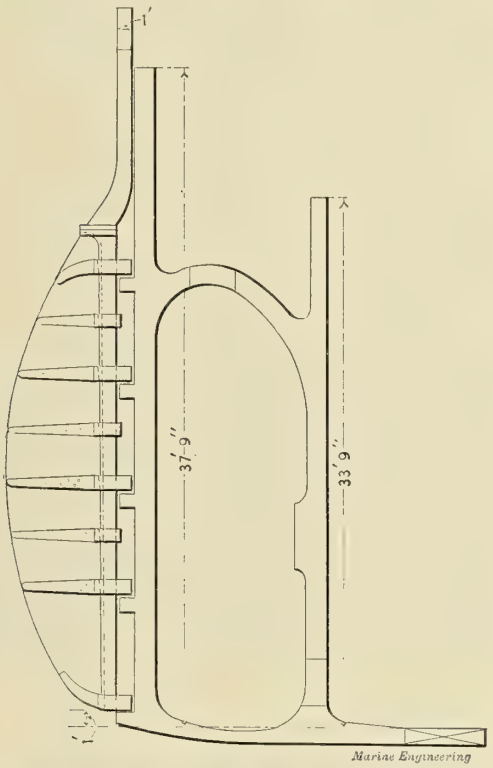
An interesting account of the repairs made is given in the *Engineer,* from which paper the following facts and drawings are taken.

British yards are not generally equipped in compressed air, but it was realized by Mr. Bain, the engineer for the Cunard Company, that the work could be done most expeditiously by the use of pneumatic tools. A pneumatic tool company of London furnished the equipment and certain of the skilled hands, the owners providing the material and labor, and the result was that the work was executed in about a fortnight.

The rudder, rudder post, and the lower part of the stern post being lost, a new forging for the rudder post was provided by the Dumbarton Forge Company. Owing to the enormous size of this forging, it was made in two portions joined by a scarf at the bottom of the rudder post, the scarfs on the forgings being made to template. The corresponding scarfs of the top and bottom stern post were made by pneumatic tools. A number of holes were drilled through the stern post by Boyer drills, and the intervening metal was next broken through by a No. 1 Boyer chipping hammer, using a tool thickened at the end. The drilling of the scarf was commenced at 9 o'clock P.M. on Saturday, the 19th ult., and was finished, with the bottom piece cut away, at noon on Tuesday, the 22d ult.; two No. 2 Boyer drills with 1 1-4-inch diameter drills, and one No. 3 Boyer drill with 1-inch diameter drill, being employed, the latter boring at the rate of 1 1-4 inches deep per minute. In one case, we are informed, a 1-inch hole was drilled 9 inches deep in seven minutes. The No. 2 drills, 1 1-4 inches diameter, bored 7-8 inch deep in one minute on an average. After the holes were thus broken through, the remaining metal was chipped to template by pneumatic hammer and chisel, the time occupied in this process being about thirty hours. The forgings were next clamped in position without much further tooling being necessary to make a good joint. Some heavy drilling was then rendered necessary for the rivet holes, of which there are twenty-four in each of the two lower joints, *A C,* Fig. 2, and fifteen in the upper joint, *B.* These were drilled 1 5-16 inches diameter, and were afterward reamed out by the same

machines to 1 1-2 inches diameter, great care being taken to prevent any movement of either of the abutting parts. Ordinary twist drills 1 5-16 inches diameter were used, and with 100 pounds air pressure a hole 12 inches long was made in fifty-five minutes, including four stops to lower down the drill on the stand. The countersinking was done with the same machines, by the aid of a special tool, with a cutter to fit the drill socket. The rivets were 11 1-4 inches long and 1 1-2 inches diameter, the heads being 2 1-4 inches diameter and 1 1-4 inches long, and the other end of the rivet had 2 3-4 inches of taper. They were made in the Cunard Company's shops, accurately turned to fit the holes tight.

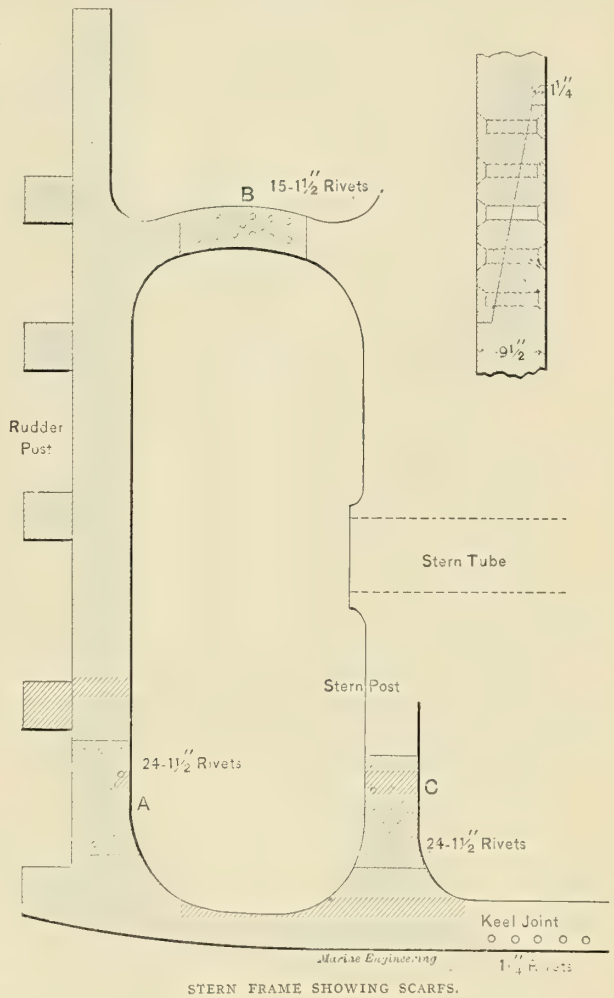
After the holes in the scarf were finished, a start was made with riveting, two Boyer riveters 1 3-4 inches by



NEW STERN FRAME AND RUDDER OF THE ETRURIA.

6 inches being used simultaneously from each side of the scarf. A couple of plates were clamped to the rudder post to provide a bearing for the riveters, and the machines were supported by means of balance weights running on pulleys fixed above the scarf. After being heated the rivets were cooled in water within three inches of their tapered ends, and were then driven into the holes by the machines. When the operator at the opposite side saw that the countersink was fairly filled he started his machine, and in an average of from thirty to forty-five seconds the rivet was close down to the metal. The subsequent cooling of the ends of the rivets caused them to contract, and tended further to close the joint. In the two joints *B* and *C* the heads of the rivets were afterward chipped off with a Boyer hammer to allow of the plating to be fitted closely over them. In the case of joint *A* this was not necessary. Some heavy chipping was necessary after the scarfs were riveted to trim the forging up to shape at the joints.

The repairs necessitated the removal of a number of the skin plates of the vessel, which involved a further large amount of punching and riveting. The keel plate on either side which overlaps the rudder post, for instance, is 18 feet long by 4 feet deep and 7-8 inch thick. Along two sides of these plates two rows of 7-8-inch rivets had to be removed and replaced. This was done by hand riveting. Along the bottom and on either side of the frame there are three rows of 1 1-4-inch rivets, varying in length from 5 3-4 to 13 3-4 inches and pitched



STERN FRAME SHOWING SCARFS.

6 inches center to center. These were replaced by pneumatic tools. Where the outer edge of these plates overlapped the stern post two rows of screw rivets were inserted by hand.

The compressor was placed transversely on the deck of the vessel near the stern, three india-rubber hose pipes of 1-inch bore being carried over the vessel's side down to the tools. The compressor was one of the Taite-Howard Company's standard types, and was supplied with steam from one of the ship's boilers. It may be stated that no difficulty was experienced with the workmen; the Cunard Company's boilermakers handled the tools with some eagerness, both when riveting the 1 1-2-inch rivets and also when doing the heavy chipping.

Saving Weight in Hull Construction.

There are many points in the construction of a vessel where weight may be saved without in any way affecting the strength and rigidity of the structure, and, although the saving in each member may seem trivial in itself, yet the total saving amounts to a quantity which should not be neglected.

One of the methods of cutting down the weight is in clipping off corners of angles and plates. Take, for example, a ship of 300 feet in length by about 40 feet beam; the frames will be 5 by 3 1-2 inches by 9-pound angles; reverse frames, 3 1-2 by 3 1-2 inches by 8-pound angles; the clips, 3 by 3 1-2 inches by 7 pounds, and the floors 20 to 23 pounds. Ordinarily, in the makeup of these essential parts, the corners of all angles, clips, etc., are left on. However, if these corners were cut off considerable saving would thereby result. By noticing the accompanying sketches, the shaded corners are evidently seen to be of no essential value in the construction, and it makes no difference whether they are on or not, as the strength of the member is in no way impaired by cutting the corner off. Any part of an angle left on where it lends nothing to the construction may be considered dead weight, and if it can be done away with at all it is certainly advantageous.

Take an entire frame of such a ship with three decks, where the reverse bars would run up to the main deck and having brackets on each deck, as shown in Fig. 3. The amount of weight that could be saved runs from 5 to 10 pounds per frame, which, in a 300-foot boat, means from 750 to 1,500 pounds. This weight, which does not seem of appreciable value, may be given due consideration when it is considered that no additional cost of frame would be incurred and no part of the ship's structure weakened. Sketch No. 1 shows reverse bar with the two ends cut off, leaving as much material where the cut is made as between the rivet hole and the end or side of flange of the angle, the backing clip with the corners cut, the frame angles shown dotted with corners cut, and the backing bar to frame and intercostal clips, which are double, with ends cut. Following the frame from the center line keelson, there would be at least one side intercostal keelson, which, with clip to floor and lug back of reverse bar for stringer angle shown in Fig. 2, gives four more corners, especially the lug, which may be cut as shown, as also the lugs of the lower and upper bilge stringers. Then the lower deck with bracket to beam may be cut as shown in Fig. 3, the dotted part being cut where bulb or channel beams are used, as the square top to the bracket is of no value, except where it can be put in the bosom of the beam, resting under the upper flanges. A lightening hole of 3 inches diameter in a 20 by 20-inch or 24 by 24-inch bracket takes no material strength from the bracket, yet means considerable weight when the number of brackets in such a ship amounts to 900 or more. Making a summary of the number of corners that could be cut on a single frame, and the amount of their weight, the brackets to decks and the weight of the 3-inch hole and cuts on them, we have for a three-deck ship of 150 frames as follows: For each frame, 52 corners of 3 1-2 by 3 inches by 8 pounds average angle, which amount to about 5 pounds, and 6 brackets per frame, which would come up to about 5 pounds. We thus find that the total saving per frame is 10 pounds, which means 1,500 pounds for the entire ship on framework alone. This idea may be carried out to advantage without any material extra cost, and in no case weakening of structure, where good judgment is exercised.

Besides saving the pounds dead weight, the cutting off of unnecessary corners lends a finished appearance to all visible structural work.

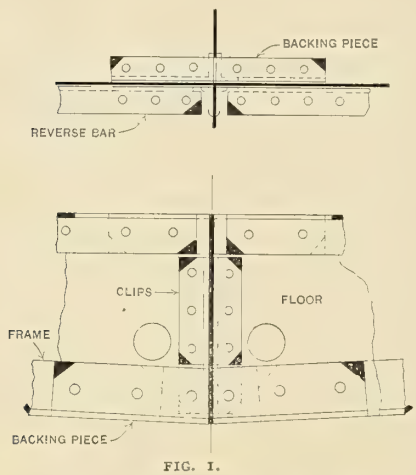


FIG. 1.

CENTER KEELSON, LOOKING FORWARD.

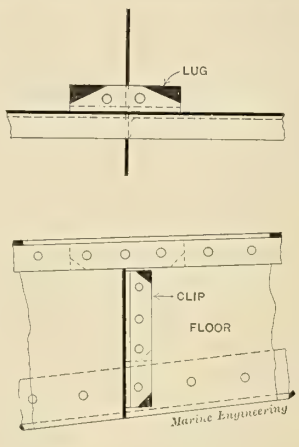


FIG. 2.

SIDE KEELSON, ETC., LOOKING FORWARD.

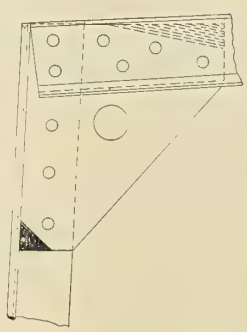


FIG. 3.

BRACKET AT DECK.

Turbine Steamer Queen Alexandra.

Reference has already been made in Marine Engineering to a new passenger steamer for the Clyde service which is being built by Messrs. William Denny and Brothers, of Dumbarton, and the Parsons Marine Steam Turbine Company, of Wallsend-on-Tyne. London *Engineering* makes in part the following remarks: The success last year of the *King Edward* has led to the construction of this new steamer. She is on the same general lines as the older vessel, but is somewhat larger, being 270 feet long, 32 feet in molded breadth, and 11

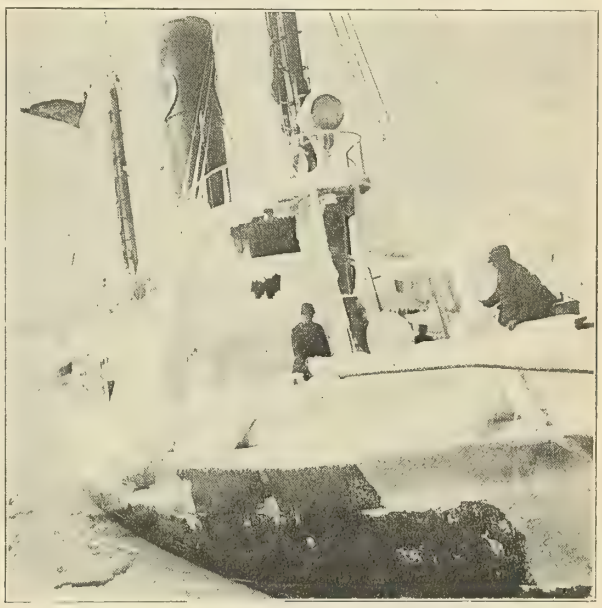
feet 6 inches in depth to the main deck. Were it not for this, the *Queen Alexandra* would so far resemble the *King Edward* that a photograph of one might almost be taken to represent the other. The machinery is practically similar in design to that of the *King Edward*. The vessel, however, is considerably more powerful, having attained a mean speed of 21.63 knots with 1,100 revolutions of the side shafts and 750 revolutions of the center shaft. The vessel is, we believe, the largest passenger steamer on the Clyde, and is also the fastest excursion steamer in Great Britain. Captain Williamson, the managing owner, has given some figures as to coal consumption of the turbine machinery. A vessel of a similar type (the name of which is not stated) steamed 12,106 knots in 80 days on a coal consumption of 1,909 tons, at an average speed of 18 1-2 knots. The *King Edward* steamed 12,116 knots in 79 days on a coal consumption of 1,429 tons, and averaged 18 1-2 knots. Thus the turbine vessel steamed 10 miles more at the same speed on a coal consumption of 480 tons less. It is worthy of note that the calculations had shown that the vessel would make 21 1-2 knots if a certain boiler power were obtained, but that if everything was worked to its utmost limit 21 3-4 knots might be reached. Everything had not worked to its utmost limit, and a speed of 21 5-8 knots was attained, which was exactly what had been anticipated. This proves that the turbine system is now on a sound basis and can be adopted with a due knowledge of what it will do. The past year's service of the *King Edward*, and the fact that those who were best able to judge, namely, her owners, have put on another vessel as a commercial undertaking, show that the steam turbine is fairly well established as a marine engine, and it may be confidently anticipated that it will play an important part, at any rate in passenger and cross-Channel steamers, doubtless leading to its adoption for larger craft. The fact that the Admiralty have taken it up for an ocean-going vessel supports this view.

TUGBOAT STARTING OUT WITH BARGES.

Ocean Towing.

Transporting coal along the coast is annually requiring more barges and towboats, and to-day one will find a large fleet of stanch vessels engaged in this trade. The barges and tugs are built especially for this service and the sizes of both are yearly increasing. Tugboats will generally take three large barges and will average anywhere between 4 and 8 knots speed on the ordinary trip. These tows are going both summer and winter, and encounter very severe weather. When possible, when a storm is approaching, a tug will seek port to wait for the bad weather to pass, but many times they encounter the winter gales in the open sea.

The accompanying illustrations were taken by a Boston *Herald* representative on a trip from New York to Boston on the ocean towboat *Nottingham*. The first illustration shows the barges as towed through the East River harbor at New York. When the open sound is reached these barges are dropped in line one after the other at about 175 fathoms of hawser. The second illustration shows the tug in port after passing through a severe winter storm where the ice formed wherever the flying spray struck the vessel.



TUGBOAT NOTTINGHAM AFTER AN ICY TRIP.

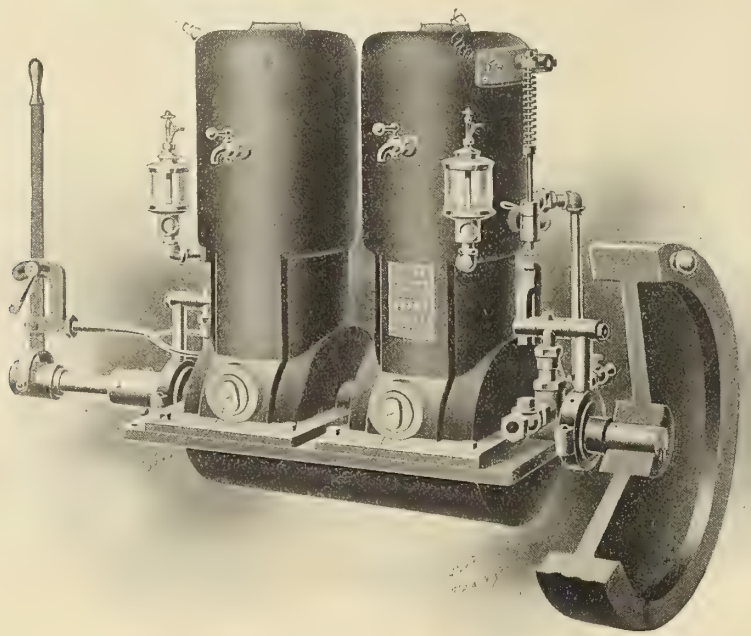
This winter has been one of the severest in the damage done to coast shipping, and the papers have had frequent accounts of barges and schooners wrecked along the coast; but the number wrecked compared to the number in the service is very small. The economy of this method of transportation is being realized, so that yearly these fleets are being increased.

Sea Duties for Naval Officers.—It is the intention of the new Secretary of the Navy to reduce the number of naval officers on shore duty and increase the period of sea service. While the Secretary believes that it is necessary for an officer to have a certain amount of shore duty, yet he believes that most of the time should be spent at sea.

ENGINEERING SPECIALTIES.

Headless Type Gasoline Motor.

The Howard motors, manufactured by the Grant-Ferris Company, Troy, N. Y., for the season of 1902 are from entirely new patterns and follow what is called the headless motor in all types. The smooth, easy finish and rounded form make this motor easily cleaned and kept in order. The sparking arrangement is inserted in the motor in the shape of a small block, which can be easily removed and repaired separately, or a duplicate can be carried. The cylinder, being practically separate from the water jacket and making contact with it at the lower end only, is free to expand and contract without undue strain, and will naturally retain its original shape when subjected to the heat of explosions much better than those motors which have varying thickness of metal at different portions on the cylinder, owing to their particular form of construction.



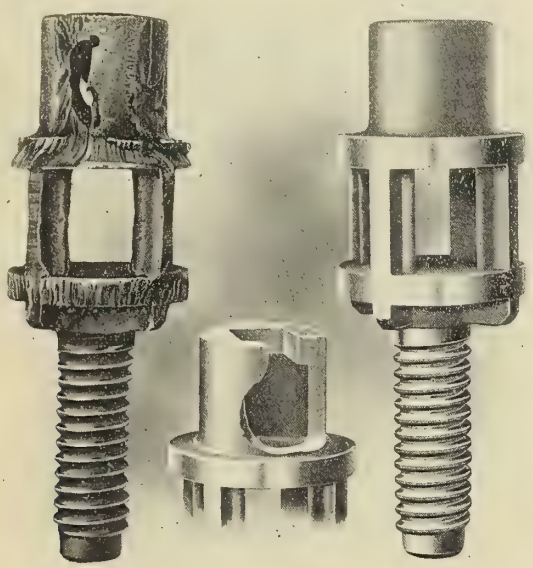
NEW TYPE GASOLINE MOTOR.

A piston that fits perfectly when the motor is cold need not necessarily be a good fit when the same is hot, the cylinder assuming a different shape, as is also true of the piston. It is also desirable to have the water of nearly uniform temperature at all parts of the motor. This can be done much better when there is a free circulation around the whole cylinder than when it is cut up in sections, one part of which will naturally get better circulation than others. By removing the lower bolts, the cylinder can be removed and taken away. The form of construction at the base is such that the bearings can be renewed and made to fit the shaft, even if it is worn down below size necessary to fit the flywheel and eccentrics. This is not the case when using solid brass boxes, which necessarily must be large enough to pass over the unworn portions of the shaft, fitting the flywheel and other parts. From the illustration, it can be seen that the oil cups, relief cocks, and handle for varying the spark are in accessible positions. The arrangement of pump and water connections is neat and convenient. A pet cock is provided for draining pump and water jacket in cold weather, and is also a convenience in noting action of the pump in discharging water. In the double-cylinder type the cylinders are rigidly bolted to a single base, giving the stability of a single casting with a further advantage of renewal of a single cylinder in case of accident. The form of generator valve used on two-cycle motors is very simple, and consists of a small cneck valve properly fitted, with a small outlet opening on the side. The arrangement under the valve is such that the spraying of gasoline into the air is absolutely prevented. The throttle is a part of the valve, and is so closely connected to the base of the machine that, without hot-air connection, the valve is kept free from freezing, as a result from the heat due to its proximity to the cylinder. The company also builds four-cycle motors of larger sizes, adopting in their construction the headless type.

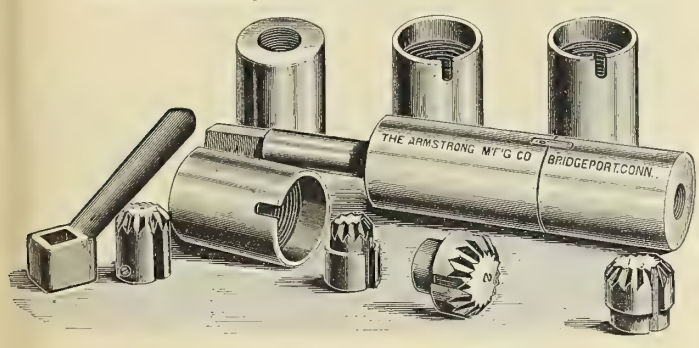
The Effect of Using a Valve Larger than Required.

A practical demonstration of the adverse effect of installing too large a valve in high-pressure steam service was furnished in a Chicago electric station recently. A 2-inch class W pressure regulator was ordered from the Foster Engineering Company, of Newark, N. J. It was placed on a 2-inch pipe containing a boiler pressure of 150 pounds. The delivery pressure was to be reduced to 15 pounds. For delivery of the steam the valve was opened but two or three one-thousandths of an inch. There was about 150 feet of 2-inch pipe between the boiler and the valve which was not covered; consequently, the steam was highly

saturated when delivered. When passing through the valve the velocity of the steam was so high that it produced some cutting, as shown by the accompanying illustration below. This photograph was made after the valve had been in service but four months. The cause of erosion was at once apparent, and a valve exactly one-half the size was installed. This 1-inch valve has been doing good service for two years and is still in operation. The substantial design of the clapper before it was affected is shown at the right. The composition used was 88 per cent. copper, 10 per cent. tin, and 2 per cent. zinc. It has been found that, while the erosion is not always as marked as in this instance, the cause of leaky valves may frequently be traced to the installation of a size larger than is necessary.



COMPARISON OF NEW AND OLD VALVE.



A NEW FORM OF NIPPLE HOLDER.

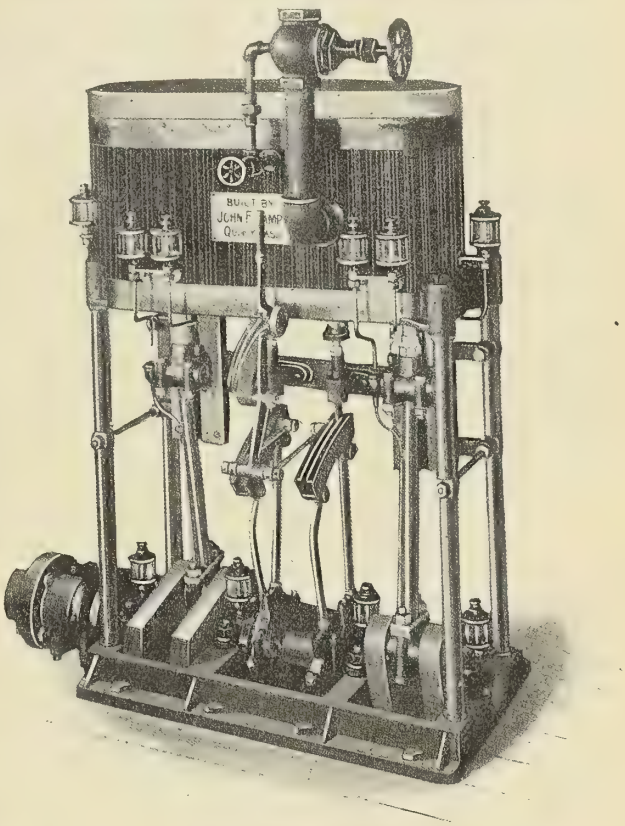
New Nipple Holder.

A new nipple holder has been manufactured by the Armstrong Manufacturing Company, of Bridgeport, Conn., to be used in connection with its No. 00 pipe-threading machine. It holds pipe from 1 to 4 inches, inclusive, by using different threaded rings and backing pieces. It will also hold close nipples either right hand or left hand, no change of parts being necessary to hold the nipple for threading it left hand. When the thread is cut the nipple can be removed with the fingers by loosening the screw in the back of the holder. This nipple holder can be furnished to hold as small as 3-4 inch if required.

Small Marine Engines.

A high-grade compound engine for steam yachts and launches is made by John F. Kemp, Quincy, Mass., and a brief description of these engines is given as follows:

The cylinders and valves are made of hard, close-grained cast iron; the frames separating the cylinders are of open-hearth machinery steel turned to fit reamed holes in cylinder lugs and bed plate. The crank shaft



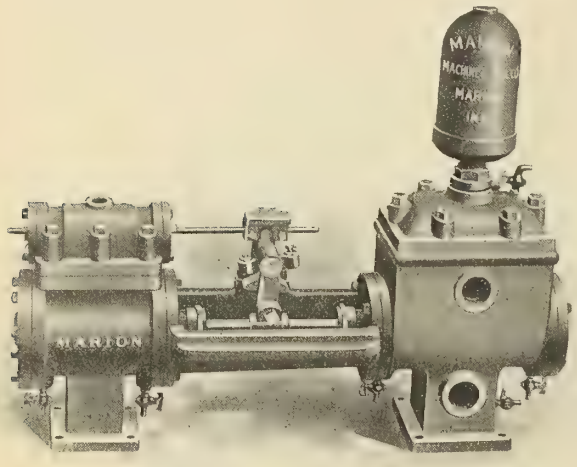
A COMPOUND MARINE ENGINE.

is of forged steel, of the built-up type, and to diminish vibration the cranks are provided with balance discs. The valves of both cylinders are of the piston type, operated by Stephenson links of the box type, and the crosshead guides, bolted to the back framing of the engine, are made for cast bronze slipper crossheads with large wearing surface. The connecting rods, piston rods, links, eccentric rods, and braces are all nicely finished. All bearings are designed with a specially large surface, and a powerful thrust bearing is connected to the after frame of the engine.

The slides, wrist and crank pins are supplied with oil from cups, thus enabling the engine to be oiled while in motion. These engines are made in sizes of from 20 to 85 horse power, the cylinders of the smaller size being 4½ and 9 inches by 6 inches, and of the latter size 8 and 16 inches by 9 inches stroke.

Steam Pump.

The steam pump here illustrated, made by the Marion Machine and Tool Company, Marion, Ind., possesses many features which are essential in the successful working of a steam pump. These are the positive valve motion and the perfect balance of the steam valves. The clearances in the steam cylinder are also reduced to a minimum, thus greatly reducing the amount of steam required. In many pumps now on the market this principle has been overlooked, and marine engineers are beginning to realize the economy of having the auxiliary machinery of good design. The valves are flat-faced, insuring that the wearing



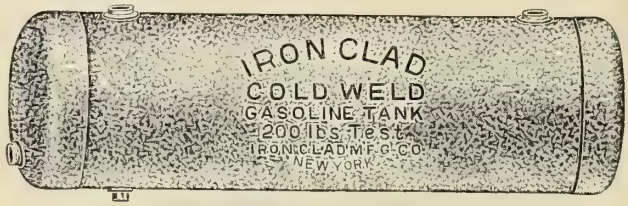
A POSITIVE VALVE MOTION PUMP.

surface will retain, and always wear to, a steam fit. The steam piston is cushioned at the end of the stroke, so that it will not strike the heads, even when under full head of steam and when the pump is working at the highest speed. The adjustment is such that the length of the stroke will not vary when changed from full to minimum load. By this cushion feature the water valves are made easy seating, thus avoiding hammering in the pipes and check valves. Brass liners are fitted in all of the water cylinders, and the piston rod and valve stem are of Tobin bronze. Each pump is supplied with sight feed lubricators, drip cocks, and the necessary wrenches.

Gasoline Tanks.

A gasoline tank for use on launches, combining neatness of design with strength and absolute security, is herewith illustrated. In the construction of this tank the use of rivets is entirely obviated. It is an established fact that every hole punched for rivets not alone weakens the material, but also produces a possibility of a leakage. No dependence can be placed on the riveting of a tank, and to make a riveted tank as secure as possible it is necessary to resort to calking as the only means. The tank here illustrated is of the cold-weld pattern, made by the Ironclad Manufacturing Company, 2-6 Cliff street, New York city, and this type is used for water, oil, or gasoline for small boilers.

In the construction of these tanks, the cylinders, which are made of heavy best-grade flange steel, are locked into a patented and specially-formed T-bar of steel. The flanged, convex heads overlap the cylinder to a depth of 1 1-2 inches, and are secured by the well-known process of brazing, after which they are heavily galvanized to protect them from corrosion. The tanks



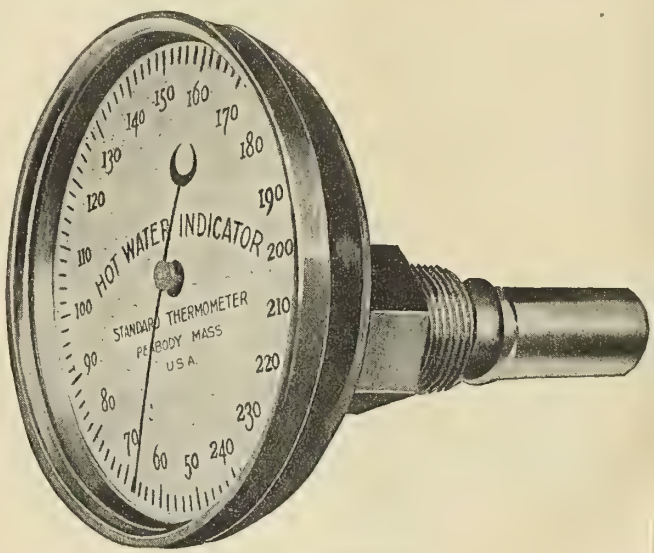
COLD WELDED GASOLINE TANK.

thus constructed are practically seamless, yet stronger, as the material has not been subjected to a heavy draw, but has retained its original tensile strength. Each tank is subjected to an actual hydrostatic test pressure of 200 pounds and thoroughly examined by competent inspectors.

The tappings, which are of best-grade malleables, can be placed in any part of heads and cylinders, in any size from 1-8 to 2 inches in diameter, as may be required.

Standard Thermometers.

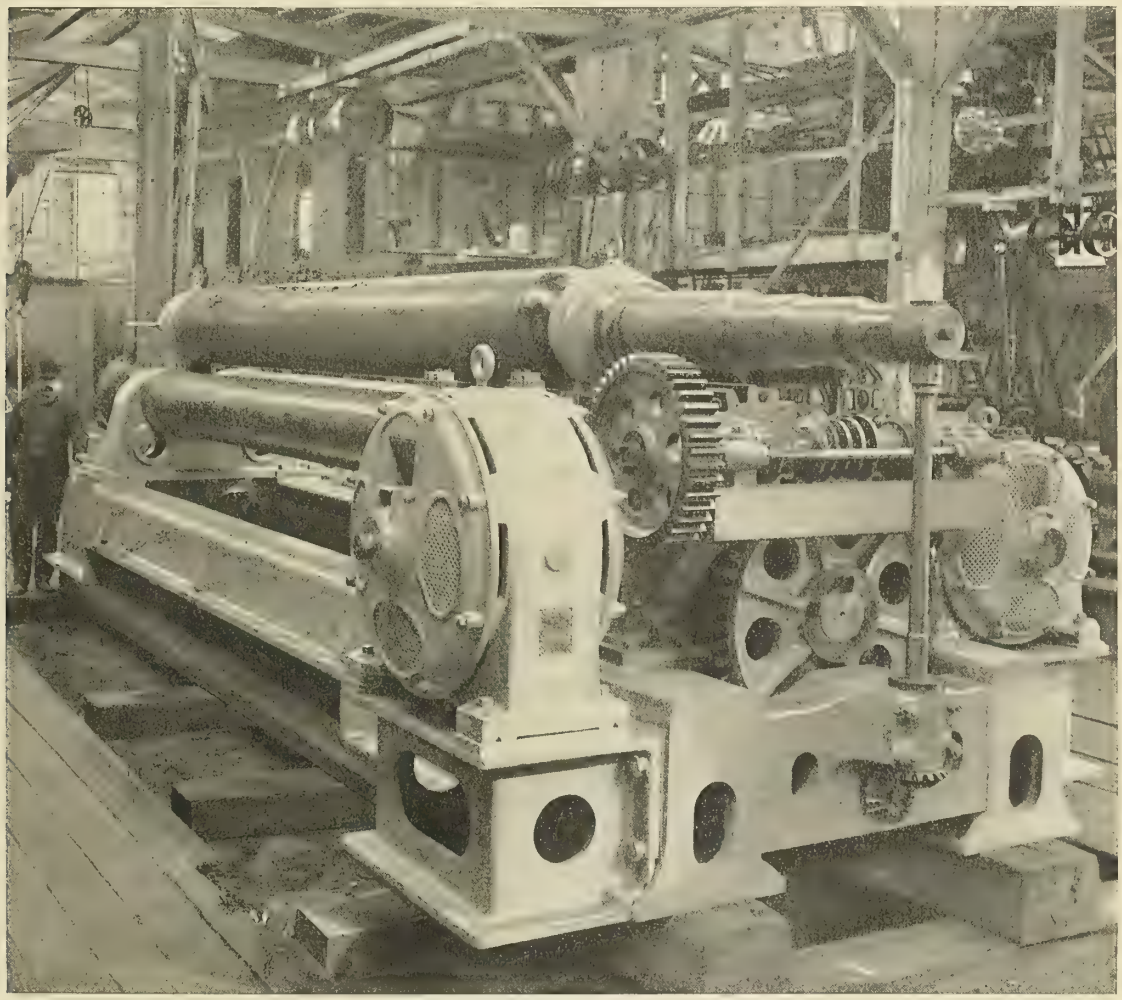
The principle of the expansion and contraction of metal is made use of in the line of standard thermometers manufactured for mechanical purposes by the Helios-Upton Company, Peabody, Mass. The fact



TYPE OF STANDARD THERMOMETERS.

that the expansion of metal is the same for each degree throughout ordinary ranges of temperature permits thermometers made on this principle to be most accurate in their readings. The indicator of this thermometer is actuated by the expansion or contraction of a bimetallic strip of metal called a lamina, which is coiled

upon a mandrel. This lamina is in the tube, as seen at the right hand of the cut, and is at such distance from the case and dial that it may be put through the shell of a boiler, through a hole drilled for that purpose, and allowed to come in direct contact with the liquid or vapor whose heat is to be taken. The temperature is recorded by the indicator hand, which travels around the enameled face. The instruments are held in place by substantial screws of regular pipe-thread size, so that the threads may be cut in the boiler by standard taps. When the instrument is thus screwed into position it is a permanent part of the boiler, and a perfectly tight joint is made around the stem. The advantages of this type of thermometer over the mercury-column instruments are, their accuracy after long-continued use, the legibility of their dials, and the slight cost of repairs.



MOTOR-DRIVEN PLATE-BENDING ROLLS.

Motor-Driven Plate-Bending Rolls.

The Continental Iron Works, of Brooklyn, have recently built and installed at their plant a new machine designed for bending heavy plates for boiler shells. The rolls measure 16 1-2 feet between housings. They are three in number and are composed of steel forged at the Bethlehem Works. The top roll, which is the idler, weighs 10 tons and measures 21 inches in diameter, while the two lower driven rolls are each 17 inches. In order to insure a sufficient factor of safety the designs, which were made by Mr. Warren E. Hill, vice-president and general manager of the Continental Iron Works, were for bending a 16-foot plate of 1 1-2 inches in thickness into a cylinder 5 feet in diameter, which it is needless to say far exceeds the demands that will ever be required of the machine.

In general appearance these rolls resemble others intended for similar work, but they nevertheless embody several distinctive features which may be noted. First, although these rolls are heavy and powerful, they are very compact and the gearing is so designed and arranged as to occupy comparatively little space. This feature is clearly shown in the accompanying cut, which is an end view showing the frame on which the motors are mounted and the arrangement of the driving gear. The motors are Westinghouse Type C variable speed and develop 40 and 50 horse power respectively. The larger motor drives the two lower rolls, and the smaller motor is employed to raise and lower the top roll. The motors take current at 220 volts, 7,200 alternations, and provide for a wide range of speed variation. They are

controlled by an operator stationed on a platform above the motors and gearing. A feature of this equipment that commends itself especially to the management is the fact that very little attention is required by these motors, that they are easily regulated and respond quickly to the varying demands for power as well as the variations in speed, and the positive action of the regulating mechanism. The speed is greatly reduced by the gearing, that of the driving mechanism being brought down from 840 revolutions per minute at the motor to 3 1-8 turns of the rolls. The top roll has an extension, shown in the cut, which exerts a counter strain when plates are being adjusted or unshipped. A vertical rod is connected to this tail piece, and is employed to adjust the position of the upper roll and to tilt it when unshipping. In this class of heavy work it is necessary to have a convenient arrangement for unshipping the shell after it has been bent, and to meet this requirement a special end bearing was designed for the upper roll, which can be readily unlocked and slipped off the roll, then lowered until it is entirely out of the way, thus permitting the cylinder to be withdrawn. When the shell has been removed this end piece is raised to its former position, slipped back over the end of the roll, locked in place, and the machine is ready for operation again. The lowering and raising of the end piece is controlled by hydraulic power. While this end piece is withdrawn the upper roll usually sags a couple of inches, but the counter strain is provided for at the other end, and the form of the free end is such that the supporting piece can be readily slipped back without any difficulty whatever.

Cable Steamer Colonia.

The largest steamer of the cable fleet, the *Colonia*, was recently launched from the shipyard of Wigham Richardson and Company, Ltd., and will soon proceed to the Pacific to lay the cable from Vancouver to Fanning Island in mid-Pacific, and thence carry the cable to New Zealand. The ship is one of the Telegraph Construction and Maintenance Company, whose project it is to complete the circle around the world of British-owned cables laid between points all of which are in British territory.

The *Colonia* is about 500 feet long, 50 feet beam and 39 feet deep, and at load draft has a dead weight carrying capacity of 10,000 tons. Four large tanks are built in her holds to carry 3,000 nautical miles of cable. The bow is overhanging and the stern elliptical. The necessary gear will be fitted at both ends for handling the cable. The spar deck is flush fore and aft and in the bridge house midships are located the officers' quarters. On the bridge deck is the captain's room and chart room, and above this is the boat deck on which is the wheel house. Farther aft is the deck house for the special requirements of the cable service, and directly aft is a large house containing the steering gear. The ship is to be propelled by two triple expansion engines at a speed of 11 1-2 knots when loaded. The deck machinery includes very powerful steam double cable gear and eight steam winches, all of which are driven by a horizontal winch boiler.

The above facts are taken from the *Engineers' Gazette*.

THE PROFESSOR ON SHIPBOARD.

Story of an Attempt to Combine Theory With Practice.

BY C. A. MCALLISTER, CHIEF ENGINEER, R.C.S.

CHAPTER XII.

The work of overhauling and repairs was continued the following day. As the Professor had seen enough of Para in his first visit ashore, he decided to stay aboard ship and look around the engine room again. Shortly after breakfast he donned his overalls and went below. He found a gang of men still adjusting the main bearings, and others employed cleaning up about the engine room. Going over to the evaporator, he looked through the manhole plate and saw one of the firemen doubled up like a jackknife and busily engaged in knocking the scale off the spiral coils. He inquired of the first assistant if that was the usual method of removing the scale, and was answered by the counter-inquiry of:

"Certainly; how else would you do it?"

To this opening the Professor replied that it seemed to him that as the coils from their very shape must be elastic, a sudden change of temperature would have the result of loosening up the scale and make it readily removable. He suggested that if steam was turned on the coils until they were as hot as they could be made, and then cold water turned on them from a hose, the effect would be to crack the scale.

"Another way would be," he continued, "to put on the manhole plates, turn on the steam until the coils and shell were thoroughly heated, then start the feed pump up as rapidly as possible so as to cause a more rapid inflow of the cool water; or, supposing you have a vacuum on the main condenser, open up the connection from the evaporator to the condenser, and open the bottom blow valve on the evaporator. This would cause a sudden inrush of the sea water and would result in loosening the scale. In either case I think you would find that a large amount of the scale would break loose and fall to the bottom of the evaporator, and that such as did remain on the coils would drop off by tapping them with a mallet or block of wood."

These methods appeared to the first assistant to be quite feasible, and he promised the college man that the next time it became necessary to scale the evaporator he would try one of them. As the man who had been working inside the evaporator came out to have a breathing spell, the Professor took occasion to look inside, and by means of the portable electric light, which he was much pleased to observe that the man had been using, he made a careful examination of the interior. He was quite surprised to see that at about the level of the water the shell of the evaporator was badly corroded, and the vertical braces were eaten away to about half their original diameter. Upon inquiry he ascertained the fact that the evaporator had been in use for a period of only two years. The first assistant also assured him that this rapid corrosion was quite common with that type of evaporators. This led the Professor to suggest that it would be economical in the end to use evaporators made of sheet Tobin bronze; he also said that the vertical braces could be done away with by using bumped heads.

"Of course," said he, "the bronze plates would cost much more than steel plates, but they would last indefinitely."

The first assistant then informed him that the latest practice with steel evaporators was to fit a soft patch belt around the inside of the shell about 9 inches above and 9 inches below the water line. If this patch is carefully sealed and cemented occasionally, he concluded that the life of the evaporator would be greatly prolonged. The Professor asked him if they ever experienced any trouble from foaming in the evaporator, and in reply he learned that at first much difficulty was met with from this cause, but it was finally found, after considerable experimenting, that the water should not be carried over 3 inches high from the bottom of the glass. If that amount of water was kept up steadily by carefully regulating the feed pump, foaming very rarely occurred.

The Professor saw that there were no baffle plates in the evaporator and that no dry pipe had been fitted. He suggested that a baffle plate fitted tightly around the circumference of the shell with a good-sized opening in the center would tend to prevent violent foaming.

"You may have noticed," said he, "that water boiling in an open vessel has a tendency to cling to and run up the sides, leaving the center depressed. The violent ebullition which takes place in an evaporator no doubt gives the water the same tendency, so you will see that a baffle plate would, in a manner, prevent this action. I suppose," he continued, "that you always test the water that you use for drinking purposes."

"Only by tasting it," replied the assistant.

"Well, that's a fairly good test," said the Professor, "but it is not always to be relied upon, as salt or other deleterious matter may exist in the water without its being perceptible to the taste. A sure method is to draw off a glass of the water and drop in a small quantity (four or five drops) of liquid nitrate of silver. If there is any salt in the water it can be instantly detected by the cloudy appearance caused by the chemical reaction of the silver nitrate with the sodium chloride, precipitating silver chloride. From a hygienic standpoint it is very essential that the drinking water should be as pure as it is possible to obtain it, but for make-up feed in the boilers it is not so important, and the evaporator can therefore be forced to its utmost capacity."

The chief engineer here walked up to where the Professor and first assistant were standing, and, after greeting his brother, said: "I suppose you two have settled the evaporator question to your satisfaction."

"Not at all," replied the Professor; "we have simply agreed that neither one of us knows very much about it."

"By the way," said the chief, "what was that you started to tell me about painting when you were down here yesterday?"

"Oh," said the Professor, "I was merely going to suggest that it would be a good idea for merchant vessels to adopt some such system as is now used on all naval vessels for painting the various pipes connected with the steam machinery. For example, steam pipes are always painted white, as they are usually covered with canvas. They might be, on merchant vessels, left unpainted without departing from the system. Exhaust pipes are also painted white, but they are distinguishable from steam pipes by the flanges at the joints; those for steam supply being painted black and those for exhaust painted red."

"Now," continued the Professor, "the water pipes are all painted green." ("Well, there's some sinse in that," muttered Barney to himself.) "The edges of the flanges on delivery-pipe joints are painted red and those on the suction-pipe joints are painted black. All pipes connected with the fire service are very appropriately painted red and have red flanges. Fresh-water supply pipes are painted blue and have black flanges, and discharge pipes are blue with red flanges. Flooding, drain, and flushing pipes are all painted pink and have pink flanges. This method, while primarily designed for convenience in tracing out the leads of the various pipe systems, is found to add materially to the appearance of the engine room. As the pipes are generally painted one color or another, the adoption of such a system on merchant vessels would not add greatly to the original cost of painting. Another good feature aboard naval vessels is the system adopted for labeling all valves, cocks, connections, etc. With the innumerable fittings of this kind that now constitute such important parts of modern steam machinery, some such system as this is not only very useful, but almost indispensable. To be sure, it is possible for a man to learn every valve and connection about a ship without their being marked, but it takes a very long time, I imagine, for him to master it. Take that manifold there, for instance; I suppose that in a couple of hours or so I could, by crawling all around the ship, lifting up floor plates, etc., find out just where each valve connected. On the other hand, how much simpler and better if the name of the compartment to which each suction valve connected was indelibly cut into the rim of the handwheel, or stamped on a brass plate secured opposite each valve on the bulkhead! Another useful indication is an arrow stamped on each handwheel, with the words 'to open,' so as to show which way to turn the wheel to open the valve. A few precautions like these tend to simplify matters about the engine room greatly, and make it possible for a new man to catch on to the lay of things without wasting a lot of time in studying them out."

The chief turned around and said: "Barney, how would you like such a system around here?"

That worthy replied: "Shure that would be too aisy; ivery granehorn that we shipped would soon know as much about things as any of us old hands."

The chief, however, admitted that there were some merits in the painting and labeling systems, as he remarked that on every trip he had a large number of new men to break in, and that frequently serious mistakes were made on account of the men not being familiar with the valves.

"Why," said he, "it was only last trip that one galoot was told to pump up the boilers, while we were at the wharf, with the auxiliary feed pump. I thought from the sound of things that something was wrong, and upon examination I found that the man had opened the bilge connection on the manifold instead of the valve connecting with the feed tank. Now, if those valves had

been marked as you suggest such an incident would not have happened."

The Professor, encouraged by his brother's commendation, went on to suggest that the arrangement of tools could be systematized so as to avoid the necessity of delay in hunting them up in case of emergency. "You should have all wrenches for use around the top of the engine arranged in a neat wrench board secured to one of the bulkheads within easy reach. Each wrench should have stamped on it the purpose for which it is intended. In the lower engine room the wrenches for your main bearing bolts and crankpin bolts should be hung up in a rack convenient to the engine and each one stamped. By such arrangements the wrenches would always be in accessible places, and if they became mislaid their absence from their proper places in the racks would soon attract the attention of one of the engineers. If I were a seagoing engineer I think I would pay a great deal of attention to the tools used for overhauling, as I can readily see, from the experience I have had on this trip, that a great deal depends on having the proper tools on board ship and knowing just where to put your hands on them."

It was now about 3 o'clock in the afternoon, and, as all the overhauling was completed, preparations were being made to get under way again. In putting away the tools, etc., which were used in adjusting the bearings, the Professor noticed that the caps had evidently been lifted by two dirty old rope tackles. This led him to remark that it would be very much better to have a couple of small differential hoists for the purpose.

"It seems to me that there is too much grit and dirt hanging on to that old rope to make it advisable to use around bearings. If you use chain tackle they can be easily kept clean and you don't have to bother with making the end fast every time they are used."

"Those things are too expensive for our company to furnish," replied the chief. "The superintendent would have a fit if I asked him to buy such gear."

As the ship was to sail early in the evening, the Professor washed up and togged himself out in a clean white duck suit. As he sat out under the awnings he looked out toward the ocean and inwardly prayed that no more tropical squalls might come up during the remainder of the voyage. On the run down to Rio Janeiro the weather turned out to be very fine, and the trip was made without incident worthy of note. The ship spent about a week in that port, as it was the end of her run. The Professor spent several days ashore, and enjoyed visiting the various places of interest very much indeed. He took occasion to purchase a number of curios for his friends at home, and in doing so he would involuntarily count the number of days before he would be able to deliver them. When sailing day finally came, with a whole lot of new passengers to study and get acquainted with, there was no happier man on board than the Professor. His one object now was to get home and get as far away from a ship as possible. Had there been an intercontinental railroad in operation at that time there is no doubt but that he would have returned by rail.

On the morning after the ship sailed the Professor did not put in an appearance at the breakfast table. When the chief missed him he went to his room and found his brother lying in his berth suffering with a high fever. Whether it was due to the water he drank on shore or to the spirits that he did not drink will never be known; but at all events the Professor was a very sick man. The ship's doctor was immediately summoned, and at first was inclined to think that he had a genuine case of yellow fever on his hands. Later developments proved that it was not that dread malady, but a severe case of malarial fever. For days the sufferer was confined to his room, and at times was delirious from the fever. Every attention was given him by the officers of the ship, and even old Barney would spend much of his time off watch in his state room, where he would alternately fan him and tell him stories to cheer up his drooping spirits. When the ship got off Hatteras the Professor had so far recovered that he was able to sit out on deck and enjoy the cool breezes which now were encountered. The thought of being so near home proved to be a better tonic than any that the doctor had given him, and by the time Sandy Hook was reached he was able to walk around without assistance.

When the vessel finally reached the wharf the Professor, now more emaciated than ever, went around and bade all the engineer's force good-by and thanked each of them for the attention they had given him. Remembering his kindness in giving them the money he had won at Para, the hearty grips given him by these lusty fellows were enough to make him wince. After he had gone they all agreed that he was, as one of them expressed it, "a domnd good fellow." The Professor had obtained the chief's permission to take old Barney back to the college with him, where he obtained a position for the oiler as chief engineer of the steam-heating plant at a salary of $75 per month. As the Professor was so weak after his illness, his brother accompanied him home to the college town. As the term did not begin for three weeks yet, the Professor went up to a mountain resort, where he rapidly regained his health. In ruminating over his experiences on shipboard he made up his mind that the place for a theoretical man is on shore, and that practical men would be much better off if they had a little theory combined with their practical knowledge.

(The End.)

New Turbine Yacht.—The new steam yacht *Revolution,* which has just been built and equipped with Curtis turbines, is reported to have beaten the Sandy Hook steamer *Monmouth* in New York harbor the first of last month. This is the first vessel to be equipped with successfully operating turbines in this country.

Prize Contest.—The Council of the Society of Naval Architects and Marine Engineers, 12 West Thirty-first street, New York city, is authorized to offer a prize, not exceeding two hundred dollars in value, for the best paper upon some subject directly pertaining to naval architecture or marine engineering. The papers submitted in competition for the prize must be sent to the secretary before October 1, this year, and should be plainly addressed and marked, "For prize competition." The prize offered at the last annual meeting evoked such valuable papers that it has been wisely deemed to make a similar offer this year.

Heaving Down Whaleships.

Editor of Marine Engineering:

The article in your issue of February, regarding the manner in which whaleships used to be "hove down" for calking and coppering, takes me back to the days when several hundred whaleships hailed from this harbor. There were three good reasons why it was customary to "heave down." In the first place there were nowhere near enough marine railways to go around, consequently it was necessary in most cases to resort to some other means. In the second place it was a cheaper method of doing the work.

Probably the most important reason was because there was more or less strain on the ship, and the seams were opened a little so that the oakum could be driven home to better advantage. You, of course, know that the whaleships in those days usually went off on voyages of four or five years, and if they were

DECK SCENE DURING BOILING.

VIEWS ON A WHALER—SCRUBBING WHALEBONE.

calked when hauled out on a marine railway, it was more or less of a question whether the calking would hold out during the entire voyage; but if the calking were done with the ship "hove down," the calking would, in all probability, outlast the voyage and the ship be much tighter.

Your readers, perhaps, will be interested to see two pictures which illustrate life on a whaleship. The first picture is a deck scene during the "boiling." The two men in the foreground are "mincing" blubber, and the man at the left is towing a bucket of minced blubber around to the other side of the try works. There is so much steam arising from the try works that nothing can be seen in the picture except the two smoke stacks indistinctly. After the oil has been boiled out of the blubber, the "scraps" are skimmed out of the try pots and put into the press shown near the left of the picture. The press is represented as open, and the screw is shown which is used to give a final squeeze to the scraps so as to secure the last drop of oil. At the extreme right is the cooper, who is drawing the oil off from the cooler ready to transfer it to the casks so that it can be stowed in the hold.

The other picture is a deck scene when the crew are washing the whalebone. In the background are the two big deck pots, where the "bone" is immersed in boiling water, then, slab by slab, it is laid out on planks as shown in the middle of the picture, where three men can be seen scrubbing a slab.

It is so many years since any whaling of any consequence has been done in New Bedford, that it is now a very rare occurrence for a whaleship to sail from this port.

New Bedford, Mass. Fairhaven.

Oil Lubricated Tail Shaft.

Editor of Marine Engineering:

I have read with much interest the several articles in Marine Engineering on the galvanic action of the tail end shafts, and well realize what vital parts of the ship the stern tube and tail shaft are. But how little we know of what is going on inside that tube; it is lucky sometimes that we don't know or we would be liable to jump off at the first port. In some first-class companies which I have sailed for they make a rule of examining the tail shaft every year, but how many steamships are there whose tail shafts are never examined until they have a warning of something wrong? Galvanic action going on inside the tube or under the brass liners gives no warning.

I can see a shaft now which came out of a steamer bad enough to make one's blood run cold at the thought of being at sea with a tail shaft in such condition. It certainly would have been condemned long before it got in such a state, but no one knew anything about it until the propeller broke and had to be replaced by a new one, when the shaft was examined. By the breaking of that propeller the ship and lives of those on board may have been saved. If brass, rubber or gutta percha liners are put on the shaft we certainly cannot tell what is going on under those liners until they are taken off, and very few steamship owners will consent to that.

Mr. Editor, I wish to ask you and the readers of Marine Engineering what is wrong with a tail shaft turned up and polished all over with two bearings slightly larger in diameter than the rest of the shaft, these bearings to work in babbit instead of lignumvitae, the cast iron stern tube to be tapped in the center for a pipe say one inch or so in diameter, the pipe led into the shaft alley and connected with a compression grease cup which is worked by a pawl and ratchet from the main shaft and is regulated to keep a pressure on the tube greater than the outside water pressure, so that no water can get in. There being no brass, copper or salt water inside the tube the galvanic action will be reduced to a minimum, the shaft will be easy to examine when drawn, and being polished the least flaw can be noticed. Marlin Spike.

Page's Magazine.—In the month of July, 1902, the first number appeared of *Page's Magazine*, which, according to the statement of the editors, is to be devoted to engineering, shipbuilding, iron and steel, electricity, and mining industries. It is published in a very handsome style, 8 by 21 inches in size. As stated in the introduction, the above-mentioned industries have been chiefly responsible for the remarkable advance of the present age, and it will be the purpose of the magazine to bring these subjects before the public in a comprehensive manner. It is stated that the magazine will be an "essentially English production with the advantage of American ideas and methods, which will be pressed into service in just those directions in which our experience has shown that they are desirable." It is just these American ideas and methods of publishing a magazine which will so highly recommend it, if its artistic and literary merits continue to be as excellent as the first specimen. The articles therein contained include Naval Notes from the Powers, well illustrated with views of battleships; sketches of James Swinburne and C. T. Yerkes; then comes a monthly *résumé* of the various mechanical industries of the world. Next is an article on the Developments in Cyanide Practice, following which are Locomotive Engineering Notes. The Glasgow Tramways are well described and illustrated; then follows an article on Milling Machines, both English and Foreign. A department which will probably develop with age is that of Workshop Practice. The succeeding pages are devoted to articles on Iron and Steel Manufacture, Prime Cost, Business System and Organization, the Modern Foundry. A review is given of the notable British papers of the month and several live topics are taken up. An attempt is made to review some of the Continental papers, and the closing sections are devoted to Correspondence and the books of the month. The editorial pages for this month are 128 in number, which is a remarkably good showing for a new magazine. The field to which the paper is to be devoted is, indeed, an extensive one, embracing the entire mechanical world, and the only criticism that may be forthcoming is that too much has been attempted and that, therefore, but small space can be devoted to any one subject. The editorial and publishing offices are at Clun House, Surrey street, Strand, London, W. C., and the International News Company, New York city, will receive American subscriptions. The subscription price is 37 cents a copy, or $4 a year.

TECHNICAL PUBLICATIONS.

Self-Propelled Vehicles. A practical treatise on the theory, construction, operation, care and management of all forms of automobiles. By James E. Homans. Size 6 x 8 3-4 inches, pp. 632, with 466 figures in the text. Price $5.00. New York, Theo. Audel and Company.

The purpose of the publishers in bringing out this book has been to meet the increasing demand for a thorough treatise on the subject, in the belief that such a work cannot fail to have value to the ever-increasing number of those who are becoming interested in the automobile, either as users or builders.

This field of engineering work is somewhat peculiar, in that it involves the interests of so many persons who lack previous acquaintance with engineering matters of all kinds, and in consequence the style of treatment called for is peculiarly simple and somewhat more detailed and elementary than would be otherwise required. The author has, therefore, introduced an elementary presentation of the theory and operation of steam boilers and of steam and gasoline engines and of the electric motor. The discussion of the gasoline engine is especially noteworthy, and it will be found of interest and value to all concerned with this type of motor, which is becoming as firmly fixed in the marine field for the operation of small boats as for the motive power in the modern automobile.

The book as a whole takes up the matter first from the historical standpoint, followed by a discussion of the modern motor vehicle, with a description of its parts and a discussion of the principles involved in its operation. Following this are given in detail descriptions and discussions of the various methods and means of powering such vehicles, steam, gasoline, and electricity.

The discussion of the various parts of the modern gasoline engine, both of the two-cycle and four-cycle types, is especially full and should be of great value to those concerned with machinery of this type. Chapters are given on the general principles of gas-engine operation; on the methods and conditions of gas-engine cylinder cooling; on gas-engine efficiency and on estimating the horse power of gas engines, as well as descriptive of the various parts of a modern gas engine, their mode of operation and derangement to which they are subject.

The book closes with general hints and advice regarding the operation and management of motor vehicles of the various types.

The book is finely printed and the illustrations are profuse and, for the most part, excellent in execution. The purposes held in view, both by the author and publisher, seem to have been well realized, and the book may be recommended to all interested in motor vehicles and their management, while the general chapters on the gasoline engine will be found of value to the far wider range of readers who may be interested in motive power of this character.

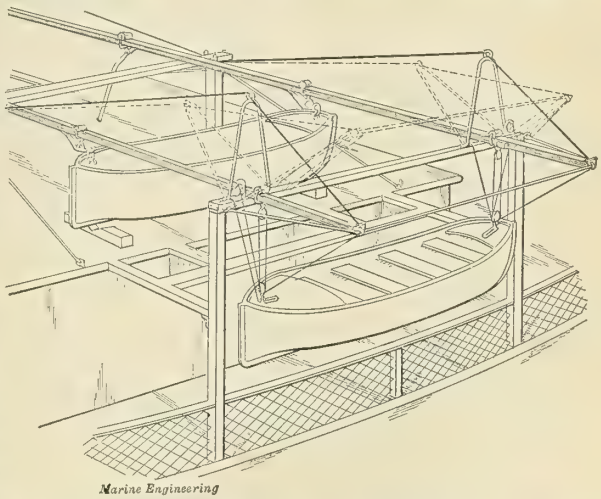
Notes on the Construction and Working of Pumps. By Edward C. R. Marks. Size 5 by 7 inches, pp. 187, with 117 cuts. Price three shillings sixpence. London, The Technical Publishing Co.

The author of this book states that it has been prepared for the user of pumping machinery rather than for the designer or maker, and he has in consequence considered the leading styles of pumps and pumping engines as the user receives them and in the finished state. The earlier chapters, however, deal with a variety of topics relating to pumps in general and to the principles involved in their operation. In the later chapters the various types of pumps and pumping engines actually on the market are taken up and described, with some discussion of their peculiar characteristics or suitability for various classes of work. Naturally the illustrations are drawn from British practice, and while therefore the book will be of much interest to all engineers concerned with pumping machinery, its special value will be rather for those whose practice leads them into contact with machinery of British construction. Since, however, the principles are throughout the same, and since the same general topics are met with on both sides of the Atlantic, and to some extent the same actual makes of pumps, the American reader will find in this book much that will be to his direct aid in connection with the installation and operation of pumping machinery of all types. The descriptions seem to be clearly written, the types well chosen, and the illustrations such as to supplement the text sufficiently for the purpose in view. The book is one which may be recommended to all who are interested in this field of engineering work.

SELECTED MARINE PATENTS.

700,408. TIDAL MOTOR. RICHARD W. DERBYSHIRE, DAGENHAM, ENGLAND.
Five claims.

701,009. LIFEBOAT LAUNCHING DEVICE. JAMES W. BEDFORD, SAN FRANCISCO, CAL.
CLAIM.—1. In a launching apparatus, the combination with track-rails, and supports therefor, of a trolley device mounted upon said rails and including a pivoted elevating member normally disengaged from the boat, and adapted to engage and suspend the boat.



Marine Engineering

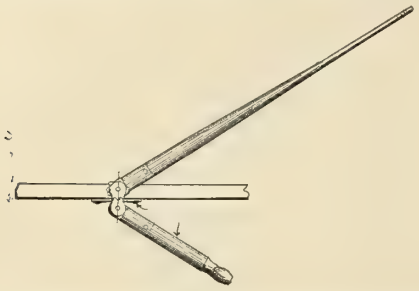
2. In a launching apparatus, the combination with track-rails having hinged sections at the ends, and supports for said rails, of a trolley device to travel on the rails, and a swiveled lifting device normally attached to the trolley, and disengaged from a boat and adapted to engage and elevate the boat and suspend it.
Eight claims.

701,329. AUTOMATIC SELF-INFLATING LIFE-PRESERVER. JAMES GRAHAM, CARNOUSTIE, AND ROBERT R. TATLOCK, STIRLING, SCOTLAND.
Four claims.

701,595. FEATHERING PADDLE-WHEEL. JAMES MERKEL, WELLERSVILLE, OHIO.
Twenty claims.

701,759. OAR. KNOWLTON C. McNEILL, CHANDLERSVILLE, ILL.

CLAIM.—1. The combination with a rowboat of an oarlock comprising an inwardly-turned hook secured to the inner surface of the side of the boat, an oar comprising two sections having a gear connection and plates between which the gears are supported, one of said plates having depending ears connected by a cross-rod engaging under the hook. Two claims.



702,129. CONTROLLER FOR PROPELLERS. WILLIAM COOPER, DENVER, COLO.

CLAIM.—2. In steam-driven vessels, the combination of a propeller; a horizontal cylinder in the hull of said vessel open to its full diameter to the sea at a point in the stern of said vessel adjacent to said propeller; a piston reciprocating in said cylinder and acted upon in one direction by sea-pressure and in the other direction by mechanical means; boilers; propelling engines; a steam line connecting said boilers and said engines; a valve in said steam line; an exhaust on said steam line between the boilers and said valve and coupled with said valve, and means whereby said valve is operated by the movement of said piston in said cylinder. Three claims.

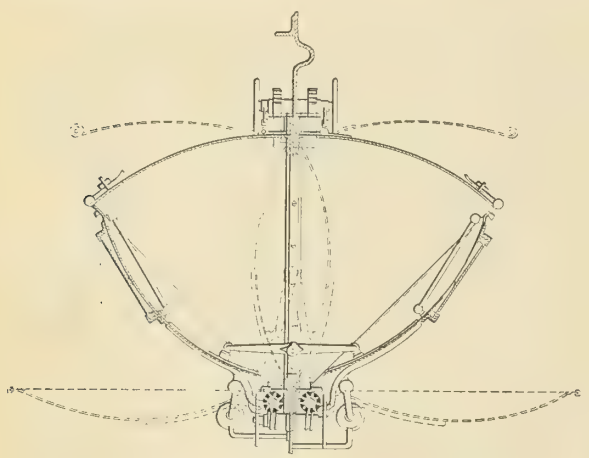
11,999. REISSUES. STEAM TURBINE. JOHN BURGUM, RIO JANEIRO, BRAZIL. FILED DEC. 26, 1901. SERIAL NO. 87,239. ORIGINAL NO. 641,074. DATED JAN. 9, 1900.

CLAIM.—1. The combination, in a steam turbine, of an external fixed cylinder and an internal revolving drum, having their interior and exterior surfaces provided with a series of longitudinal steam-directing blades, and a series of transverse steam-directing partitions intersecting said blades; the blades and partitions terminating centrally between the ends of the cylinder and drum to provide a central annular steam chamber, and the outer edges of said partitions being substantially in line with the outer edges of the blades. Five claims.

702,399. LIFEBOAT. LEMUEL BROWN, SAUGATUCK, MICH.

CLAIM.—1. A lifeboat comprising a central compartment and end sections, a false bottom, a pivotally-mounted floor section in the form of an auxiliary boat suspended from above and above the false bottom, and means for adjusting the height of said floor section and allowing it to rock to compensate for the rocking movement of the boat. Two claims.

702,651. BULKHEAD DOOR. WALTER W. IFE, BUFFALO, N. Y.



CLAIM.—1. In a bulkhead doorway, in combination, a pair of similar, interconnected doors positioned at substantially a right angle with each other and both hinged to the same door jamb, a concave casement upon the opposite jamb within which the free edges of said doors oscillate and closely fit, and sealing devices, the bulkhead co-operating with either door when in closed position. Fifteen claims.

702,705. FLOATING DREDGE. EPHRAIEM CHAQUETTE, NEW ROCHELLE, N. Y.

CLAIM.—1. A floating dredge, provided with a longitudinal channel therethrough with its ends enclosed, a dredge carriage moving on a suitable track extending along said channel near the water line, a chain-bucket dredging apparatus and its operating mechanism supported on and carried by said carriage, and a dumping-apron car adapted to receive material from said chain-bucket dredge and convey it to the discharging apparatus, substantially as described. Two claims.

702,728. SUBMARINE BOAT. JOHN P. HOLLAND, NEWARK, N. J., assignor to Electric Boat Company, a corporation of New Jersey.

Two claims.

702,965. FLOATABLE CAISSON FOR CLEANING SHIPS' SIDES AND BOTTOMS. ROBERT KAUCHER, ROCHESTER, N. Y.

Four claims.

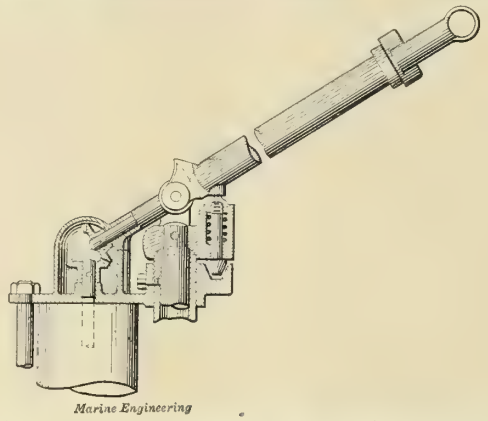
703,139. STELLAR COMPASS AND GREAT CIRCLE-COURSE PROJECTILE. ROBERT T. LAWLESS, ALAMEDA, CAL.

Eleven claims.

703,181. MARINE PROPELLER. CARLOS CONSTANTINO DA ROCHA CARVALHO, LISBON, PORTUGAL.

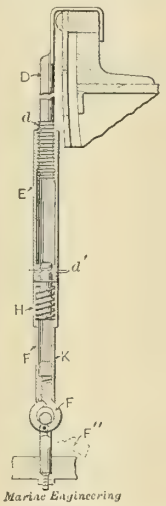
Four claims.

703,552. STEERING GEAR. WALTER A. CROWDUS, CHICAGO, ILL.



CLAIM.—10. In a steering gear, the combination of a fixed support, a steering post revolubly mounted therein, a head on said steering post, a steering lever pivoted to said head, a lock bolt mounted in said head beneath said steering lever and adapted to be depressed thereby, a groove in the fixed support in which said steering post is mounted adapted to be engaged by said lock bolt, said lock bolt and groove being correspondingly tapered, and a spring applied to said lock bolt and adapted to maintain the same normally retracted. Ten claims.

703,664. BOAT LASHING DEVICE. SWEN NILSON, BOSTON, MASS.



CLAIM.—1. The herein described boat lashing device, consisting in combination of a hooked screw-threaded rod *d*, *d'*, *D*, an adjustable internally-screw-threaded sleeve *E*, a hooked rod *F*, rotatably connected to said sleeve, and provided with a pivoted latch *F''*, a sleeve *H*, secured to the upper end of the rod *F*, and a longitudinally-adjustable spring-pressed latch holding sleeve *K*, substantially as and for the purpose set forth. Two claims.

703,713. SAFETY RELEASING DEVICE FOR THE SHEETS OF BOATS, TOW LINES, ETC. CHARLES SMITH, SOUTH CROYDON, AND GEORGE J. HONE, ROMFORD, ENGLAND.

CLAIM.—1. A device for holding and for automatically releasing the sheets of boat sails, tow lines, and other connections, upon the application of a predetermined amount of force. Five claims.

703,739. ANCHOR. JACOB E. RECH, PHILADELPHIA, PA.

One claim.